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VIEWS, NEWS AND INTERVIEWS.

It seems that the marvelous increase in bogus electrical appliances in England has affected the English electricians quite considerably, as they are practically powerless to prevent the public from being victimized. Americans treat this kind of fraud in a different manner, for it has been formally announced that no electric belt or similar so-called electro-medical appliance shall have space in the Electricity Building at the World's Fair. The head of the department has classed them under the head of "secret nostrums," and as such they will not be allowed floor space.

There is no limit in the practice of electrical engineering; it is not like other branches of engineering, they are fairly well defined in their scope, but it is impossible to tell when and at what time electricity will be introduced into other branches of business.

Another use has been found for electricity. In Ceylon experiments have shown that it is more economical to dry tea leaves by its agency than by the old method, and extensive plants have been erected for that purpose.

The tunnel at Niagara Falls is finished and the power plant will be in operation by next March. It is expected that a current of 45,000 electric horse-power will be transmitted from there to Buffalo, and 30,000 to other points.

An instrument has been perfected by means of which a fireman at a hose nozzle can communicate with the man in charge of the fire engine. Tests have been recently made that show that the device possesses merit.

A new system of railway conduits is reported, which is dependent for its insulating qualities in wet weather upon the principal of the diving bell. The wires are supported in the top of an inverted trough, made in short sections with closed ends, but open at the bottom, so that when water fills the conduit the air contained in the inverted troughs will prevent the water from rising to the height of the wires. It looks as if the device were quite practical.

An excellent method of decomposing sodium chloride into caustic soda and chlorine has recently been discovered by an English chemist. The process has heretofore not been economical, owing to the destruction of the anodes by the chlorine, and the liability of the products to recombine after being separated. This has been overcome by the use of a compound anode so treated as not to be attacked by chlorine and a diaphragm which renders recombination impossible. It is said that the process is a commercial success, due to the fact that there is but one operation, and the chlorine may now be used for bleaching purposes.

A case recently came into the courts in Georgia and it was decided that a telegraph company is not excused from using care because a message is ungrammatical. A Georgia beef dealer has recovered a verdict because the Western Union Telegraph Company did not deliver to a cattle dealer the message "How is cattle? Answer at once?" The sender of the message had about 15 head of cattle on hand when he sent the message, and waited several days for an answer. It cost him several dollars a day to care for the cattle, and when he sold them the prices had declined and he lost $30 or $40 more. These amounts and the penalty of $100 he recovered from the telegraph company.

A decision has been rendered by the Supreme Court of Georgia, which exempts telegraph companies from penalties for failure to deliver messages on Sunday. The court holds that under the Georgia code it is unlawful for any person, including a telegraph company, to pursue his business or the work of his ordinary calling upon Sunday—works of necessity or charity only excepted. This decision might produce peculiar and interesting results if it were followed by the courts of other States having similar laws.

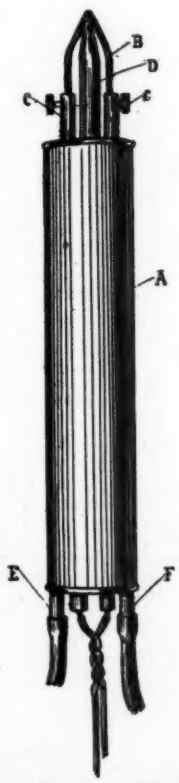


FIG. 1.—TOOL USED FOR ELECTRIC ENGRAVING ON GLASS.—(See page 177.)

Meeting of the New York Electrical Society.

The next meeting of this Society will take place in Professor Chandler's lecture room, Columbia College, Forty-ninth street and Madison avenue, on Thursday, December 1, at 8 P. M.

Prof. Edwin J. Houston, of Philadelphia, will deliver a lecture on the "Magnetic Field," which will be illustrated by lantern projections and experiments.

The Electric Car Fender.

It is not often that the proverb, "An ounce of prevention is worth a pound of cure," is brought so forcibly to our minds as in a case which occurred recently in Boston. A great newspaper sensation was spoiled and no occasion was given for another of the now monotonous "Another victim, etc.," headlines. Two innocent little children, while crossing the street, placed themselves directly in front of a rapidly moving trolley car. Quickly, with all his might, the horrified motorman reversed the current and by a supreme effort managed to stop the car. But alas, too late—a crash—and a heart-rending scream pierced the still night air—all was over. Eagerly the terrified occupants rushed forward. Shrieks came from mothers in the car who thought of their own darlings at home, and some of them buried their faces in their hands to keep out what all expected. Tender hands lifted the poor little children—and quickly they scampered off, thoroughly frightened. The fender had quietly lifted them from their feet and deposited them in the iron-wire basket which extended three feet in front of the car. We thank the fender for the noble part it has taken, and hope that it may long continue, as it started, in its useful career.

No Use For a Subway Commission In China.

There are no telegraph poles in China. This is not due to the fact that there are no telegraph lines nor because there is no suitable wood or materials which may be used for poles, but the reason is purely a religious one. The Chinese worship their ancestors, and regard their last resting places so sacred that they deem it a sacrilege to allow even a shadow to be cast upon their graves. When the linemen of the first telegraph companies began operations they were greatly embarrassed in their work by crowds of natives who followed them about, and, with the most frightful blasphemies, cut down the poles as fast as they were erected. For some time it was impossible to obtain any explanation; but at last it was discovered that, in the more thickly settled districts of the Empire, graves were everywhere to be found, and scarcely a pole could be erected anywhere but that at some time of the day its shadow could be seen upon a grave. It was very evident that it was impossible to overcome this difficulty, and the Chinese Government was entirely powerless in the matter. So the solution was to bury the wires with the ancestors, and the underground system has proved perfectly efficient.

Death of Mr. W. I. Barker.

William Irving Barker, of Boston, died suddenly of apoplexy at the Quincy House, Wednesday, November 23. Mr. Barker was widely known throughout New England, where he has resided for many years past, engaged in electrical journalism. For nearly three years Mr. Barker had been manager of the New England office of the ELECTRICAL REVIEW, and was ever a loyal, earnest and capable representative, possessed of the strictest integrity and most constant industry.

It is with unfeigned grief that we chronicle the decease of Mr. Barker, and we are sure all who knew him as he really deserved to be known will deeply regret to learn of his death. Mr. Barker was about 40 years of age and unmarried.

ELECTRIC RAILWAYS.

A SERIES OF VALUABLE ARTICLES FROM A PRACTICAL PEN.

Improvements in Construction of Electric Railways in Nearly Every Department—The Neglected Return Circuit—Too Much Dependence on Mother Earth—Good Reasons Explaining the Waste of Energy in the Return Circuit.

BY T. J. McTIGHE, PH. D.

The Return Circuit.

The construction of electric railways has been constantly improving in nearly every department. Cars and trucks of greater stability have been designed; motors of increased power and reduced gearing have been perfected; controlling devices, while not greatly changed in principle, have felt the vigorous touch of the mechanical designer; overhead fittings and material have been vastly improved; generators and switchboard apparatus have come under the practical domain of the machinist-electrician, and the track-rails, joints and methods of laying have joined in the march towards perfection of operation and maximum life. But the return circuit has been rather neglected. It has been largely a case of "out of sight out of mind." Originally installed on a basis evidencing immature study, after burial it has been left severely alone in most instances, possibly with the thought, if any occurred, that Mother Earth would lend a helping hand and open up a frictionless path for the expiring pressure to get back to its origin. Once a road is in operation few care to earnestly investigate the efficiency of the return circuit. Such a study is tedious and annoying, and to make comparisons between one style and another is more difficult still, owing to absence of reliable facts.

That a great deal of poor work has been done is undoubtedly true, however, and a few instances encountered by the writer will show this.

In one case, while the tracks were at the nearest point less than 1,000 feet from the switchboard, the road was started before the line equipment was completed, the return being through a track making a detour of over a mile. Until a heavy main return was carried from the nearest main track, there was a loss of over 15 volts under a current load of 200 amperes. Yet the detour track was well bonded at all joints throughout.

In another case the main track passed the power-house and had a spur into it, to which a temporary main return was connected (for a couple of days pending proper construction) by about 50 feet of No. 00 copper wire. Besides, the station had several large drive well casings 40 feet deep connected to the switchboard, and the tracks at frequent in-

tervals were connected to "earths" consisting of iron pipes driven below water line. Yet for those few days the No. 00 wire frequently got uncomfortably warm. No measurements were taken of the loss of energy.

In another case, the tracks were about 1,000 feet from the switchboard. With about 25 motor cars the main return on test showed a fall of potential reaching 13 volts.

In another case, the power house was a half mile from the tracks, and there was a six per cent. grade two miles away. The track was well bonded and new. All was not quite ready and the wire ordered for the main return had not arrived. Good looking ground plates had been sunk below water line at power house and at both ends of line. A start was made on the usual entreaty of owners to "let her go" for a few days anyway. A 24-foot open car with two horse-power motors and about 70 passengers almost stalled on the grade. The line constructor, fortunately, was experienced and full of expedients. He cut one of the feeders and connected it down to the rails at the point nearest the power house, and after that the cars mounted the grade with a rush. Yet that track was bonded at every rail joint with two No. 0 iron rail-bonds well riveted.

Many other cases have fallen under the writer's observation demonstrating inadequacy in the main return, and a large number of instances have as clearly shown a similar want of capacity and the presence of an undue resistance in the track circuit.

Several reasons occur to the writer as probable causes for this waste of energy in the return circuit, viz. :

1. Undue dependence on the "earth return."
2. Persistent parsimony of the railway company.
3. Insufficient capacity in the main return.
4. Insufficient capacity in the rail bonds.
5. Bad work in applying the rail bonds.
6. Inherent mechanical defects in the rail bonds.
7. Corrosion or electrolysis of the rail bond and the supplementary wire where such is used.

No. 1.

In the writer's belief, the electrical engineer, in planning the work, has generally counted too liberally on the earth as an important and often major factor of the return circuit. Ground plates, pipes or rods have been planted, and an inadequate bonding system followed out. The road has been started, the cars run and no further thought given the matter. But the rails are at best only a few inches deep in the ground; generally sand is the contacting substance. The result is uncertain and unreliable. The rails rust heavily, the clean metal is no longer exposed, and the result is the same thing that knocks durability out of a storage battery, *i. e.*, increased *contact resistance*. But in addition to this, what becomes of the alleged thousands and thousands of square feet of direct surface contact of the rails and bond wires with moist earth, when the temperature is near zero and the earth frozen hard and dry, even deeper than the cross ties? Neither ice nor frozen soil is a very attractive path for the electric current.

No. 2.

One of the leading causes of defective return circuits (and many other troubles, by the way) is a mistaken idea of the railway management as to possible economies. It is very discouraging to the engineer to have a veto put upon his carefully considered plans, aiming at the best results, on the ground that they cost too much at the start. No weight is conceded to his argument that power will be saved eventually, because the inexperienced management has not yet learned the lesson that a horse-power lost is just so much earnings gone to waste. The old axiom "Knowledge is power," should be paraphrased into "Power is money," and the electric railway manager soon learns it.

No. 3.

The want of sufficient capacity in the "main return," that is, the direct connection from rails to switchboard, can be a serious cause of loss of energy, and hence a tax upon the coal pile. Its incomplete character is often due to want of care in calculating, but probably oftener to an undue confidence in the earth circuit. On the hypothesis of an infinitely low resistance in the earth circuit, any heavy main return would be unnecessary; but such hypothesis, while tenable on telegraphic and telephonic circuits, where an ampere is a leviathan, becomes weak ground when dealing with a couple of thousand of such units. Without a doubt the main return is entirely too light in a great many electric railways now in operation, and, it is quite likely, in the majority of those lines in which the power house is some distance from the nearest main track.

No. 4.

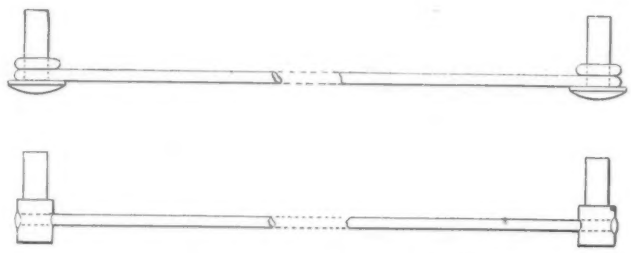
The capacity of the rail bonds is an item of the most serious significance, and this is true whether a supplementary wire is used or not. Bearing in mind that in our average American climate the ordinary earth return becomes, for varying periods in winter, almost useless, owing to the frost, it is incumbent to provide an economical and efficient return circuit which will be independent of temperature. We have nowadays a very heavy rail in use, probably, in cities, averaging 60 pounds per yard. That means six square inches sectional area, and two such rails constituting single track have 12 square inches area, collectively. This area is equal to about two square inches of copper. Does it not seem odd, then, to connect such massive conductors with No. 4 wire bonds (iron sometimes, sometimes copper), or to connect by such bonds to a No. 0 copper supplementary wire? The rails properly connected have a magnificent capacity; then why not connect them by means of a rail bond having at least the semblance of a relatively good conductivity? Let us, if we can at reasonable cost, get our return circuit independently of any help from the uncertain "earth circuit," and we shall have uniformity of performance winter and summer. Much has been said about the difficulty of operating motor cars over a snow-covered track. Perhaps much of the difficulty lies in the frozen "ground," and in the absence of adequate direct return facilities, by reason of rail bonds which are mere shadows, and a main return which is a broken reed.

One of the largest roads now building is using No. 0 (B. & S.) tinned copper supplementary wires, connected to each rail, near each end, by a No. 4 copper bond wire, soldered to a half inch copper rivet simply driven into the rail without upsetting. The writer ventures to predict that such construction will sooner or later come to grief.

Later practice has been merging towards the use of long six-bolt splice plates for the rails. This, where the ordinary type of rail bond is used, necessitates a bond from 30 to 36 inches long. If, as usually happens, the rail joint becomes rusted on the surfaces in contact, the current has to go from rail to rail *through the bonds*. These are seldom larger than No. 4 A. W. G. A mile of single track thus fitted will have as a necessary part of the circuit a total of 528 lineal feet of two No. 4 wires. If copper, the rail bond resistance will be about .065 ohms, and to get 100 amperes through it alone will cost 6½ volts. If of iron, the rail bond resistance will be about 4 ohms, and 100 amperes flowing will cost 40 volts. When the supplementary wire is used and connected to the rails near the end of each, if the fish-joint surfaces are rusted, the case becomes worse, as then the rail bond circuit from rail to rail, on standard gauge track, is twice the distance from rail to supplementary wire plus the distance between rail connections—say altogether about five feet—and the rail bond resistance per mile is nearly doubled over the preceding case, while the help afforded by the supplementary wire is trifling in comparison to its cost. Nearly all the dealers in supplies, if asked for rail bonds will show the purchaser something made up of No. 6, 5 or 4 B. W. G. iron wire, galvanized. It is because there has been too much "follow the leader" style of work, and too little independent thought bestowed upon the subject. A change for the better is inevitable.

No. 5.

Bad work in applying the rail bonds has been a fruitful source of loss of energy. Some track layers seem to have an idea that if the bond rivet is pushed through a hole loosely and simply headed up on the other side so as to prevent its slipping out, their duty has been fulfilled. The rail makers have much to atone for, too. The engineer plans to use, say, a three eighths inch rivet, and calls for rails drilled with a $\frac{13}{64}$ inch drill, and the contract is closed for many miles of rail. The rolling mill does its work faithfully, but the drill shop deserves a stick of dynamite; for the holes drilled for the rail bonds come all the way from three-eighths inch tight to seven-sixteenths inch full and thorough work is impossible. This is not a case where the engineer is to blame, but the road completed under such conditions will lose by it. Far better to drill new holes on the ground and insure a proper bonding contact. The "channel pin" method of bonding is attractive, but has defects. First, it leaves a free entrance to moisture and consequent corrosion; second, it tends to shake loose from the vibration of the passing cars and vehicles, and finally it does not insure an adequate contact, because it cannot be "upset," not even headed up. All these cause high contact resistance sooner or later.



FIGS. 1 AND 2.—SEE "ELECTRIC RAILWAYS."

No. 6.

The success of a rail bond lies in its mechanical construction. Three types have appeared on the market, every one of which is defective.

The original first type was a wire (galvanized iron or tinned copper), coiled at each end once or twice around the neck of an iron or copper rivet and soldered thereto, or fixed by dipping in melted tin (see Fig. 1). Generally the rivet has been merely driven into a hole in the rail, without any actual upsetting of the metal. Corrosion and vibration in time loosen the contact between bond wire and rivet.

So strong is the former objection that supply houses long ago brought out a rail bond composed of two rivets, with elongated heads, and a bond wire whose ends pass through the heads (drilled for the purpose), and are headed up beyond (see Fig. 2). The bond wire has been iron and in some instances copper, while the rivet ends have been of soft iron. There are probably more of this type of bonds in the ground to-day than any other. Yet they are generally defective from the first, not only by reason of inherent and necessary flaws, but because of that never ending *bete noir* of the engineer's life, bad workmanship. A large percentage of such rail bonds are badly put together, and the necessity of putting three pieces together and relying upon cheap labor and "rush" orders, must inevitably cause trouble by slighted work.

(To be continued.)

The General Electric Company issues a circular to the holders of the common stock stating that at the request of the New York Stock Exchange, the time for reception of subscriptions to the $6,000,000 five per cent. gold coupon debenture bonds is extended to December 7, at 3 P. M.

The Return Wire Discussed.

ABSTRACT FROM DISCUSSION ON REPORT OF COMMITTEE ON "A MODEL ELECTRIC RAILWAY ROAD-BED AND UNDERGROUND WIRING," PRESENTED AT THE ELEVENTH ANNUAL MEETING OF THE AMERICAN STREET RAILWAY ASSOCIATION, CLEVELAND, OHIO, OCTOBER 19–21, 1892.

Mr. Pearson, of Boston: There is one point in connection with this report on track construction which has not been touched upon to-night, and which merits attention; and that is, the return ground. In small towns and systems where there are few cars running, the ordinary method of returning the current through the rails and supplementary wire will be sufficient, unless the distance is great. On large roads where the traffic is heavy, more return grounds than have been used heretofore will have to be installed. We found it so in Boston, and from a lack of return feeders a great deal of electrolytic action was caused in our supplementary wire, and we are now putting up a large amount of overhead copper for return grounds; I do not think it possible to put it underground, as it will corrode and rust away. There is no advantage in using iron, as the conductivity is only one-seventh that of copper.

The question has been asked me if we run the positive or negative current through the trolley wire. Originally we ran the positive through the trolley wire, but we found that the action on the supplementary wires was too great, and we changed it and put the negative to the trolley wire. I do not imagine there will be much less effect, as it merely transfers the action to another point.

Mr. Smith, of Waterbury: I would like to ask the gentleman if he has had any experience of trouble with water pipes?

Mr. Pearson: I had not in mind any particular trouble with water pipes, but naturally, if you have a large volume of current going through the earth it will take hold of a water pipe or a gas pipe, or any other pipe, and there will be an electrolytic action set up; and in any large railway system, if the attempt is made to use the earth for return ground by putting in ground plates in driven wells, or by putting them in the rivers, and the return current is not provided with a good metallic circuit, it seems to me that the current must inevitably injure the water pipes and all other pipes. The current when it leaves the car goes into the ground and taking a water pipe may go a mile on that pipe, then leave it for a better conductor; the result being that the pipe will be corroded at this latter point.

This is all I have in mind on this matter; I simply wish to bring to the notice of the convention something which I think must be taken into consideration in regard to the return current.

Mr. Richardson, of Brooklyn: I would like to ask the gentleman whether he has given thought to the idea of using a portion of the old rails which we have to take up, by putting them in the ground; on the basis, as he says, that in iron there is only one-seventh of the power of transmission as of the same weight of copper. I mean to take the relative value of our old steel rails, about $13 or $14 a ton, and using five, six, seven or eight, side by side, and making a continuous pathway for the return circuit, fastening them, of course, with proper fastenings, so as to make a continuous conductor, not necessarily under the road-bed, but alongside of it, or between that and the sidewalk, so as to provide a proper return, instead of depending on gas pipes, water pipes, or the earth.

Mr. Pearson: It seems to me the difficulty would be to make a joint. If you could weld the rails together, or if you could solder them, I think possibly it would work; but I do not believe you could make the joints in any other way that would carry a large volume of current without heating and corrosion.

Mr. Richardson: Would that joint or joining need to be by copper plates?

Mr. Pearson: I think that would be a poor construction, as the iron and copper would form an electrolytic element, and cause corrosion, even if no current was passed through the joint. The passage of the current would also heat the joint and cause further oxidation.

Mr. Richardson: One other question: Is that simply a theory, or has it been tested in practice?

Mr. Pearson: It is partly theory and partly practice. We attempted, in the early days of electric railroading, to use the rail for the return conductor, not putting in supplementary wires, and found it almost

impossible to maintain a joint of any sort. Where you drive a large volume of current through the joint, oxidation takes place, and the joint soon becomes worthless. This condition will exist no matter how large the joint is made, and if you used dissimilar materials or metals, a local electrolytic action will also take place. With steel in contact with iron, the effect will be produced in a lesser degree than with copper, and it will take longer for the trouble to develop. It does not seem to me practicable to use old rails for conductors.

Mr. Baumhoff, of St. Louis: Have you compared the relative consumption of fuel with the trolley wire connected with the positive pole of the generator and the consumption of fuel when the trolley wire is connected with the negative pole of the generator?

Mr. Pearson: No, sir; we have not; it would be rather a difficult thing to do. I cannot see why it should make any difference, as the total resistance of the circuit is equal to the sum of the resistances of the various parts, and the loss in potential is proportional to the total resistance. I do not see what difference it could make whether the resistance is greater on the negative or positive side of the circuit; it is merely a question of driving the current through a certain resistance.

Mr. Ramsey, of Pittsburgh: I would like to ask Mr. Pearson in this connection whether or not he thinks it worth while to consider the use of old cables, discarded from cable roads, for the purpose mentioned? It weighs about two pounds to the foot, or about five or six tons to the mile, and may be purchased at about fifty dollars per mile.

Mr Pearson: We used considerable cable, old steel and iron cable, in getting across the rivers and connecting our supplementary wires from one side of the track to the other, but it cuts away very fast. For instance, in one place we put in seven ropes or cables, and soldered the joints thoroughly at each end, and in less than four months they were entirely gone. If you had soil which was comparatively dry and sandy, it might do for a time; in a place where the soil was moist and salty, I doubt whether you would get enough life out of it to pay for putting it down.

Mr. Richardson: There was one thing the gentleman referred to I would like to know, why there should be any more difficulty because of using copper plates and rivets in connecting the rails for a mile or less in length; for instance, laying eight center-bearing rails, each 30 feet long and connecting them as specified, why should there be any more destructive electrolytic action between the copper and iron than there is with the copper bond wires which are used to connect our rails together on the surface?

Mr. Pearson: I think, as a rule, in track construction to-day, we use supplementary wires as well as bond wires on the rails; the former having a low resistance as compared with the bond wires and joints; the greater current passes on the supplementary wire and does not go through the joint. If you cut the supplementary wire and compel all the current to pass through the bond wire, there will be trouble; but as long as you have a good supplementary conductor, so that the current does not pass through the bond wire, the joint will remain cool, and there is no great tendency to oxidation, especially if tinned rivets are used.

Mr. Richardson: Do you think there would be any more heat generated with the rails four feet underground than with those at the surface?

Mr. Pearson: The heat would depend on the amount of current passing and the resistance of the joint. Of course, the proof of the pudding is in the eating.

Mr. F. S. Holmes, of New York: I asked an experienced engineer, a pioneer, I believe, in street railroad work, some days ago, what was his experience in ground plates; and he said that in case there was a sufficient number of ground plates along the line, he found that the amperes of current divided about equally between the rail return and the ground wire. Now, in an ordinary battery, the positive pole is the pole that gives and is consumed, and the negative pole is the pole that receives deposit. The construction we have to-day, where ground plates are used for return currents, makes the trolley wire and the various plates and supplementary wire along the line of the railroad positive and the large ground plate at the station negative. This is wrong, because where this is done the supplementary wire and ground plates along the line are rapidly corroded and eaten away, while the negative plate at the station is uninjured. The conditions should be reversed, the station plate being made positive and the line plates and supplementary wire and trolley negative to it. Corrosion will thus be largely confined to the station plate, which can be easily replaced, and the plates and supplementary wire along the road will remain nearly intact. Of course, to accomplish this the current will flow out by the ground, which will be positive, and back by the trolley wire, which will be negative.

OUR LONDON LETTER.

ENGLISH ELECTRICAL HOUSES NOT INCLINED TO EXHIBIT AT THE WORLD'S FAIR—GREAT SUCCESS OF ELECTRICAL COMMUNICATION BETWEEN LIGHTHOUSES, MANY LIVES SAVED—AN AMERICAN'S GIFT OF $100,000 TO THE ROYAL INSTITUTION—ELECTRIC ELEVATED RAILWAY IN LIVERPOOL.

Very General Interest was Taken in the action of the trade section of the London Chamber of Commerce at their meeting last week, with a view to stimulate the English electrical manufacturers and contractors to secure a respectable position at the coming Chicago Exhibition. It is true that trade is very bad all round, and in several of its departments, suffering from various causes, under a serious stagnation; and it is known that firms and companies of the highest class are fighting, and will have to fight a hard battle during the next two or three months. But it is startling and painful to find that England, long claiming to be the leader, the queen of commercial industries, now fails to enter an appearance in the new but evidently important branch of electricity, at the universal gathering of the industrial world. Accordingly, a circular was issued some weeks ago, embodying Mr. W. H. Preece's admirable suggestion that as the contributions of English electrical manufacturers were few and individually not impressive, it would be desirable, for the sake of the national reputation, to form a syndicate who would furnish a suite of rooms in the Exhibition buildings lighted throughout by electricity, in the manner common to English houses. To this not one single favorable answer was returned; and we only echo the words of the chairman of the meeting, Major Flood Page, after making that announcement, "it is a great pity."

The Royal Commission appointed by Parliament upon electrical communication between lighthouses and lightships and the shore has just held its first meeting since the recess, the Earl of Mount Edgecombe in the chair. The commissioners will shortly issue an interim report. The establishment of a system of electrical communication on our coasts has thus begun well, and has already produced notable good results. During the recent stormy weather messages were freely transmitted by telegraph and telephone conveying prompt and sufficient notice of the assistance required. At Brancaster the lifeboat was called out by a telephone message from the coast guard at Thornham, and saved five lives. At Hunstanton the lifeboat crew was assembled by the same means and with similar success. While at Winterton the telephone secured the services of a tug from Yarmouth to tow out the lifeboat which could not otherwise proceed to assist a wreck on the Happisburgh Sands.

The Labors of the Royal Institution in the various departments of scientific research have received some very substantial recognition and assistance. At their general monthly meeting on Monday last the members voted cordial thanks to Mr. Thomas G. Hodgkins, of Brambletye Farm, Setauket, Long Island, N. Y., for his magnificent gift of $100,000; also to the Goldsmiths' Company for a liberal contribution of £1,000 "to aid in the continuation and development of the valuable original research which the institution is engaged in carrying on"; and to Mr. F. D. Mocatta for a donation of £50 to be applied to help the society's investigations on liquid oxygen.

The Royal society enjoys the privilege of assembling every 30th day of November and electing their council for the ensuing year. The present president and council recommend the following gentlemen for election for the year 1893: President, Lord Kelvin; treasurer, Sir John Evans; secretaries, Prof. Michael Foster and Lord Rayleigh; foreign secretary, Sir Archibald Geikie; other members of the council, Captain W. de W. Abney, Sir Benjamin Baker, Prof. I. B. Balfour, W. T. Blandford, Prof. Carey Foster, R. T. Glazebrook, F. Duncan Godman, Prof. John Hopkinson, Prof. J. Norman Lockyer, Prof. J. G. McKendrick, W. D. Niven, W. H. Perkin, Rev. Prof. B. Price, the Marquis of Salisburg, Adam Sedgwick and Prof. W. A. Tilden.

New Installations are starting upon every side through London and its suburbs, and also in many of our provincial town, the dull foggy days and long dark evenings doubtless stimulating the popular demand for the new and brilliant illuminant. The electric lighting of Smithfield Markets appears to possess rather a public character. The inaugural ceremony took place on Friday evening last week, in the poultry and provision section of the Central Markets, which completes the series of markets erected by the corporation. The Lord Mayor and Lady Mayoress were present. The length of the wire required to complete the installation was about 40 miles, while the number of incandescent lamps fitted on the premises reached 1,200 of from 15 candle-power to 50 candle-power each. The main avenues were lighted with 100 lamps of 50 candle-power each, forming altogether the largest private incandescent scheme yet undertaken. Upon the invitation of Mrs. Charles Sax, the Lady Mayoress then removed a jeweled dagger placed in a piece of mechanism on the platform and the whole range of the markets was at once flooded with electric light.

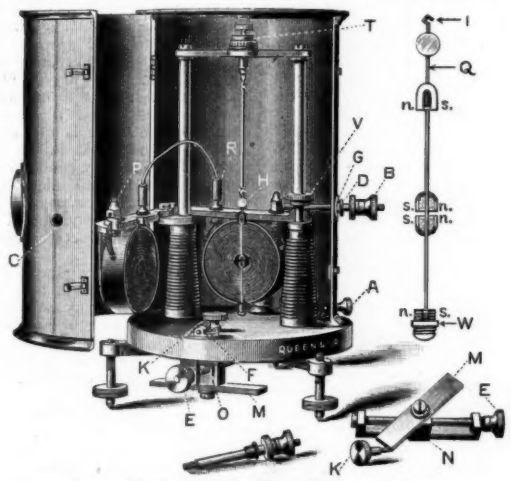
The Acute Stage of the struggle between gas and electricity has been reached in Carlow, where, as I informed you at the time, the electric lighting was recently introduced. Several householders who adopted electricity as the ordinary illuminant still retained the gas meters, so as to be able to fall back upon the gas in case of failure in the other supply. At the last Quarter Sessions the gas company brought an action against such a householder to compel him to give up the meter as it was the company's property. The judge, without deciding the question which had been raised as to the right of the company to refuse gas to a consumer when he pays for what the meter registers, dismissed the case on the ground that the company had no right to remove the meter until they had first cut off the connection with the mains.

The Famous Cathedral of Vienna, one of the largest and most perfect Gothic structures in the world, was for the first time lighted by electricity at the afternoon service on Sunday, October 24. On the Saturday preceding a trial of the installation was made in the presence of His Eminence Cardinal Grusche, Archbishop of Vienna, and proved very successful. There are 12 arc lamps, each of 1,000 candle power, four in the central nave and four in each of the aisles. The illumination was simply perfect, less devotional, perhaps, to some persons than the "dim religious light" to which we are accustomed in our churches; but it brought out with brilliant effect the magnificent architectural and decorative details of the sacred edifice.

The Duke of Marlborough, recently deceased, had for the last two or three years assumed a prominent place in scientific affairs. On Tuesday night he was in his usual health and spirits, but on Wednesday morning he was found dead in his bed. A coroner's inquest declared that he died of heart disease.

Science has lost an old and eminent servant in Mr. Edward Graves, engineer-in-chief to the telegraph department of the general post office. He also died on last Wednesday morning, universally respected and regretted.

London, Nov. 19. JOSEPH FFRENCH.



QUEEN & COMPANY'S NEW GALVANOMETER.

TELEPHONE CHAT.

Steps are being taken to establish telephonic communication between Denmark and Sweden under the sound.

A telephone line will be built along the George's Valley Railroad, from West Warren to Union, Me., and to the Warren kilns.

It is said that the Russian government is going to buy the Russian telephone system. It ought to get it cheap. At all events, a telephone line which has stood the pressure of the Russian language for a year or two must be decidedly the worse for wear.

There is a new system being tried in the West by which it is proposed to do away with operators at central stations. A company known as the Strowger Automatic Exchange intends to relegate the telephone girl to the rear. Local electricians appear skeptical as regards the commercial success of the exchange.

The telephone company of Holyoke, Mass., find that their business has increased so rapidly during the last few years that the present force is not large enough to do the business. The company is now considering some important changes. It is likely that the switchboard will be enlarged, or a new one put in. The cables will be buried for a short distance.

The police tug "Stokey," of Philadelphia, can boast of telephone connection with the world on shore. A telephone has been placed in the main cabin, and when at achor off Vine street the instrument is connected with a switchboard on the wharf by a heavily insulated wire. Those on board can be connected with any telephone in the city, or with any point reached by the long distance line, without leaving the vessel.

Successful experiments have been made in France relative to the introduction of telephones for use in warfare. The telephonists are organized in sets of two men each, each set being provided with equipment for a mile line. The very simple receiving and transmitting apparatus remain attached to the military cap, and the wire on reels in a sort of breast-plate, being so light that a man's ordinary equipment weighs less than six pounds. At a distance of 14 miles an order for an assault, setting in motion two army corps, was received and put in execution in ten minutes.

A Standard Ballistic Galvanometer.

A new ballistic galvanometer, manufactured by Jas. W. Queen & Company, is represented in the accompanying illustration.

In the making of this instrument care has been taken to obtain wire having the thinnest and firmest possible insulation, to secure minimum waste space. The coils are graded and are arranged to be joined in series, multiple, differentially or singly. The coil frames are interchangeable and are made to gauge. The suspension is a very fine quartz fibre which has proved far superior to silk, being perfectly elastic and showing no "set." Supported upon the rubber pillars are brass rods carrying the torsion head, divided into 15 divisions. The method of varying the sensibility within the widest limits, without "drift," is accomplished by altering the magnetic moment of one or more of the magnets of the system, by strengthening or weakening their fields by means of a device attached to and moving with the system itself. As no exterior magnetic field is used, this instrument has absolutely no "drift," except the exceedingly small one due to the shifting of the earth's meridian itself. Periods of vibration of over a minute are easily obtained with an absolutely inappreciable "drift."

A regular light suspension is also provided, to be substituted for the ballistic system, as both have hooks resting in corresponding hooks attached to the fibre and can be interchanged very readily.

The ballistic system weighs 4.5 grammes and the light system 0.35 gramme.

The coils are wound with a total resistance of 500 ohms.

The instrument is one that will prove of great service where very delicate measurements are to be made, and is manufactured in the usual excellent style of Messrs. Queen & Company.

Commercial Electrolysis.

EMILE ANDREOLI, IN LONDON "ELECTRICAL REVIEW."

A few months ago, Mr. J. Swinburne read, at the Institution of Electrical Engineers, a paper on the "Problems of Commercial Electrolysis," which has since been published in all the technical papers in this country, as well as in America, France, Germany, etc. Since then, I have been watching for a criticism of this work, in which Mr. Swinburne had incorporated the essence of other articles on the electrolysis of chlorides which he had written for *Industries*, and which also went round the electrical press in both hemispheres; but to my great surprise, the whole has passed without comment, and Mr. Swinburne's suggestions and notions were seemingly accepted without controversy, protest or discrimination. A short time before, Mr. J. W. Swan, at the Royal Institution, and Mr. H. Fontaine, at the Société de Physique, in Paris, delivered lectures on the progress of electrolysis and especially of electro-metallurgy, but the object of these competent men was merely to give an *exposé* of the development of electrolysis, especially in connection with the deposition of metals, while Mr. Swinburne's ambitious programme is to foresee the direction in which others must seek for future developments, in the hope that it will lead to the expression of the views both of electrical engineers and of manufacturing chemists, and to a further approach to common ground.

I respect Mr. Swinburne very much when he speaks of dynamos or apparatus which, like transformers, are his specialty, but when he treats *ex cathedra* the question of electrolysis and of its problems, I feel greatly encouraged in submitting my modest remarks to the attention of the electricians and of electro-chemists. Unless what Mr. Swinburne said is not contradicted or refuted, every person interested in electrolysis, every student who will devote himself to electrolytic researches and experiments, will believe that the ideas expounded in the "Problems of Commercial Electrolysis" are accurate scientifically, and practically true. Therefore, I thought I might say my word on this paper which, if instead of having been written by Mr. J. Swinburne, had been simply an article of popular science, signed by an unknown electrician, would never have been noticed.

This opuscule is a sort of challenge. No one in the press has yet taken up the gauntlet, and I doubt very much whether the Institution of Electrical Engineers will discuss the "Problems of Commercial Electrolysis," which is merely a compilation accompanied by comments; at all events, I hope Mr. Swinburne will not take in bad part the criticisms I will briefly and rapidly make of his dissertation. His statement that commercial electrolysis does not involve any mystery, and that it is a method of oxidizing and reducing and nothing more, may be correct when applied to accumulators, but everything is somewhat mysterious or almost unknown when secondary reactions take place, as is the case in many electrolytic operations, such as the decomposition of a chloride of sodium solution, which shows the formation of chlorine, hydrogen, hydrochloric acid, hypochlorite, chlorates, soda, reduction of hypochlorite, etc.

Commercial electrolysis does more than oxidize and reduce, in this sense, that it must cheaply decompose, separate, or combine certain products, and this formation or extraction of substances is the real difficulty to overcome, and what renders this task harder is that the conditions for solving the problems are different for almost every branch of industry which electro-chemistry seeks to appropriate from the domain of ordinary chemistry.

Shall I be blamed if I say that I dispute this calculation of the cost of electrical energy, which, according to Mr. Swinburne, if a plant put up to give a million watts is running day and night, and if the best engines and the best dynamos are employed, cost about 0.25*d.* per kilowatt hour? This estimate is theoretically true; it is the expression of the ideal of cheapness under exceptional circumstances, but the average cost of electrical energy in existing factories is more, much more, than one farthing.

OXYGEN.

I merely quote the estimate given by Mr. Swinburne, which shows that, allowing 2 volts as the pressure required, the cost of oxygen formed from an alkaline solution by electrolysis with iron electrodes, comes out at 5*s.* 7*d.* per 1,000 cubic feet, and that as the output in oxygen must be small, *we must take a much higher figure than one farthing per kilowatt hour, double the price and say* 11*s.* 2*d.* Besides, Mr. Swinburne speaks of packing the oxygen in cylinders and of adding the trade charges, and brings the price up to something like 15*s.* per 1,000 feet, while the retail price of Brin's oxygen is 2*d.* per cubic foot, equal to £8 6*s.* 8*d.* per 1,000 feet.

According to the experiments made by Scheurer-Kestner two years ago, 12½ horse-power produce in one hour, 1 kilo. of oxygen, representing 700 litres at 0.760 degrees and 125 grammes of hydrogen, representing 1,400 litres, therefore 1,250 horse-power would give 100 kilos. oxygen=7,000 litres.

At 1½ kilo. of coal per horse-power, 12½ horse-power cost 18 kilos. of coal; consequently, 1 kilo. of electrolytic oxygen costs 36 centimes for fuel only.

Latchinoff and Commandant Renard have recently introduced some very remarkable improvements in the cheap production of oxygen.

Where is the problem for the Institution of Electrical Engineers?

ALKALI.

The electrolytic production of soda is a much more serious and delicate matter, and Mr. Swinburne has, I regret to say, the most strange ideas on the production of hypochlorite, or of chlorine and caustic soda. Where on earth has he found that salt costs about 15*s.* a ton, and that three volts, with a reasonable current density, is a liberal allowance? On what grounds can he safely base his estimate of a ton of 70 per cent. caustic soda and 1½ ton of bleaching powder at £5 0*s.* 6*d.*?

Electrical energy.....	£3	15	0
Salt.....	1	2	6
Lime.....	1	3	0
	£5	0	6

No doubt, electrolytic chlorine and soda are cheap, but the cost of electric energy and salt is more than Mr. Swinburne represents it to be, and if the item of lime is 23*s.*, salt must cost more than 22*s.*

I will not cruelly insist on some heretical ideas professed by the inventor of the "hedgehog," but I would like to see how he would successfully demonstrate that in the production of electrolytic soda and bleach, "the difficulty," as he believes it, "and the only difficulty, lies in the anodes."

No doubt the destructibility of anodes is a great obstacle to the progress of commercial electrolysis; but the evil is not so terrible as Mr. Swinburne says, and he paints the devil blacker than he really is, or is supposed to be. Another time, I will treat of the *rôle* of the anodes, and especially of carbon anodes in the electrolysis of chlorides; but, in doing so, I will base my arguments on facts. Mr. Swinburne quotes Bartoli and Papasogli, who, in 1882, pointed out that carbon was attacked when used in any solution which evolves oxygen. "Without knowing of their work," says he, "I found the same by a series of experiments carried out in 1883."

If my memory is good, these experiments were made in connection with a carbon anode for a secondary battery constructed by Mr. Swinburne, and I take this opportunity to say that Bartoli and Papasogli had not the good fortune of having their admirable work on "Electrolysis by Means of Carbon," translated into different languages as the "Problems of Commercial Electrolysis" have been. The fact is that, excepting a short extract on the formation of mellitic acid, I am not aware that their lectures and essays were even translated into English. Thus may all electricians know that under the action of sodic hypochlorite, all natural or artificial forms of carbon are completely destroyed with formation of bioxide of carbon, oxalic acid and mellitic acid (C_{12} H_6 O_{12}), and that under the influence of the electric current in an electrolyte of pure water or acidulated water, carbon is oxidized and produces direct, either mellitic acid or mellogen. But very few know how and why a carbon anode can resist the action of oxygen or chlorine and last for a long time in a chloride solution. I will not fail to publish at the earliest opportunity the full account of the experiments made by the two Italian scientists, and it will be accompanied with figures and details on the durability of anodes.

Mr. Swinburne, therefore, is not quite right when he says: "Though carbon does not seem to combine with chlorine during electrolysis, I find that it is always attacked, even in a solution of salt. I have tried every kind of carbon I can think of, and the result has always been that the anode was corroded."

I wonder what experience of carbon Mr. Swinburne may have, to state that carbon is also troublesome mechanically, and that it is difficult to make good contacts with it, especially when there is chlorine about.

If he agrees to give me a transformer of a given capacity, I am quite willing to have constructed for him a carbon anode measuring, say, two or three square yards, which he will be able to work for a very long time. I do not pretend this carbon plate will last forever; nothing is imperishable, nor even insusceptible of change; but it will be of good service, and work long and well.

Is it not really exasperating to hear an electrician of such standing as Mr. Swinburne making this bold assertion: "I am inclined to think that progress is barred in this direction solely by *the want of a good anode.*" No, Mr. Swinburne! you may have the best, the cheapest and the most durable anodes; but if you do not have something more in your tank, if you do not know something else, if you have not passed the ordeals of experience, sometimes accompanied and very often unaccompanied with success, in the commercial production of hypochlorite or chlorine and soda, you will not obtain any good results, even with the best indestructible anodes.

I must confess that I do not quite understand what the writer of the "Problems of Commercial Electrolysis" says of his experiments on sodium sulphate, and of small traces of chloride left in the sulphate which corroded his lead anodes. But, *passons!* it would take too much space if I had to point out every criticisable point; it is sad to see that the destructibility of the anodes is such a dreadful nightmare for Mr. Swinburne that he constantly returns to this favorite topic, the corrosion of the anodes.

Why does he not speak of the unattackable anodes made of phosphide of chromium (Parker and Robinson), or of ferro-silicon, or of an alloy of iron and titanium (C. Hopfner)?

I expected Mr. Swinburne would have, in his usual masterly fashion, handled this question of hypochlorite which was, and is still, generally considered as the most important problem of commercial electrolysis, but he hardly touched it, and simply, *en passant*, spoke of Hermite, and once more renewed his complaint about the anodes, as if the whole difficulties of the production of electrolytic hypochlorite were surmounted by the use at the positive pole of a substance which is not attacked by chlorine or oxygen.

"For paper works it is obviously cheaper to supply lime and get bleaching powder and caustic, than to make sodium hypochlorite only. This may, however, depend on the anodes. Platinum anodes are used in this process, and it seems to be the case that platinum is not attacked in an alkaline chloride. If this is so, it is possible to produce hypochlorite of soda, but not caustic and bleaching powder." Evidently Mr. Swinburne does not see the point, as it is quite immaterial whether the hypochlorite is produced by means of carbon or platinum anodes.

We must now recognize as an undeniable fact that an electrolytic hypochlorite solution is not considered as an economical bleach by the paper maker; we must bow to such a decision, and, therefore, there is no longer any prospect for the electrolysis of chlorides in view of forming a substitute for bleaching powder.

Hereafter, a statement and estimate made some time ago, and which the electrician who made it repudiates now in the most complete manner, because, he finds it more advantageous to produce chlorine for making bleaching powder or another strong hypochlorite than to transform a chloride solution into a weak hypochlorite. "Assuming that the yield of the electrolysis of a solution of chloride of sodium is only one gramme per ampere hour, a dynamo of 1,000 amperes and five volts will produce 1,000 grammes (one kilo.) of pure active chlorine per hour, equal to 24 kilos. per day of 24 hours. A dynamo of 1,000 amperes and 100 volts will consequently produce 20 times more chlorine, and the yield will be 20 kilos. per hour in the 20 tanks, *i. e.*, one kilo. per hour in each tank, which represent 480 kilos. of chlorine per day of 24 hours, or 1,056 lbs. of chlorine. Given that chloride of lime contains 33 per cent. chlorine, this quantity of active chlorine produced by electrolysis is equivalent to 3,168 lbs., nearly 1½ tons of bleaching powder.

"If, instead of one dynamo, two dynamos supply each 1,000 amperes and 100 volts, and 40 tanks, the yield of chlorine will be doubled, and at the end of 24 hours we shall have 960 kilos. of chlorine, corresponding to 6,336 lbs. of chloride of lime, *i. e.*, more than 2¾ tons.

"Supposing the engine driving the two dynamos to be of 300 indicated horse power, requiring 3 lbs. of coal per indicated horse-power per hour, *i. e.*, 900 lbs. of coal per hour, equal to 21,600 lbs. per day of 24 hours, a little over nine tons at, say, 10*s.* per ton; this will cost £4 16*s.*, to which, if we add £4 4*s.*, for labor, salt, oil and sundries (which is a great deal too much), the equivalent of 2¾ tons of bleaching powder will cost £9, while at the price of, say, only £6 5*s.* per ton, the same quantity of bleaching powder would cost £17 4*s.*" All this is well and good; but even assuming that the Hermite process allows, as stated by Messrs. Raoul Pictet, Lacombe, Heilmann and Cross, and Bevan, inaccurately to obtain 1.56 gramme to 1.80 gramme of chlorine per ampere hour, which, if it were true, would be much more than the theoretical yield, it does not pay in the bleaching of paper pulp and fibre to substitute hypochlorite of magnesium or sodium for chloride of lime, as, in the transformation of a chloride solution into hypochlorite, part only of the salt is decomposed, and the largest quantity which an electrolytic hypochlorite may contain is a little more than three grammes per litre. If attempts are made to make the solution stronger and raise its chlorometric strength to four grammes, heat is developed, chlorate is formed, the hypochlorite is reduced, there is a waste of electricity, and the liquid is spoilt. Therefore, to get one kilo. of chlorine, it requires 300 litres of liquid, and when this weak bleach is exhausted, there is a considerable loss of salt.

The following figures were given to me by a manager of a large paper mill; from them everyone can draw his conclusions, and form an idea of the quantity of water required and of salt lost in bleaching 20 or 40 tons of pulp per day.

First. Twenty cwts. of raw esparto (or 10 cwt. of air dried pulp) carry 2,324 gallons of water, which is made up of 2,068 gallons water and 256 gallons bleach liquor.

Second. With the present arrangement of drum washer, I can wash out of the above 556 gallons, which represents what water can be got back.

Third. By experiment, I find that the bleach liquor of six degrees Twaddell's hydrometer, contains 18.7 grammes of chlorine per litre, and that the 2,324 gallons, or 10,559.3 litres of water and bleach liquor contain 2.1 grammes of chlorine per litre, which is the strength in the potcher.

From the above we can see that Mr. Swinburne in his paper does not deal really with the problems of commercial electrolysis; he does not seem to realize the difficulties with which electricians have to contend in making hypochlorite or chlorine and caustic soda.

Last month I saw in London one of the largest paper makers in America, who had a great experience and knowledge of electrolytic hypochlorite. "We spent a very great amount of money," he said, "in experimental and practical applications of electrolysis in our mills in the production of hypochlorite, but we were compelled to abandon it, as the quantity of chlorine contained in the bleach is too small in comparison with the salt which is of no use in the potcher and which is afterwards lost. Bleaching by hypochlorite is an Utopia, an utter chimera, a nonsense, and what we demand now of electricity is to supply us with chlorine and soda."

CHLORATES.

The manufacture of chlorate of potassium is carried out in Switzerland and *not in France*, as Mr. Swinburne puts it, not under the direction of Mr. Gall de Montlaur (which would be the same as if I spoke of Mr. Ayrton-Perry), but of Messrs. Gall and de Montlaur, the two inventors of the process.

Their anodes are made of thin platinum sheets (one-tenth of a millimetre), which, after having been in constant use for several months, were found not to have lost any weight. Here we are! An anode has at last been found! Why does not Mr. Swinburne mention this very important fact that at the anode a very thin platinum sheet is not corroded by oxygen or chlorine?

As a complementary information, I will say that in the beginning Gall and de Montlaur employed an alloy of platinum and ten per cent. of iridium, but now they use pure platinum.

The electromotive force in the preparation of chlorate is 4.34 volts, the current is 50 amperes per square decimetre and the tanks are provided with porous diaphragms.

ELECTROLYSIS OF FUSED SODA.

Mr. Swinburne alludes to the Castner process, and adds, "Whether this process has had any success commercially, I do not know."

I can tell Mr. Swinburne that I had last year some price lists quoting the sodium manufactured by Castner at 1*s.* 8*d.*, or 1*s.* 10*d.* per pound. I may also say that this cheapness of sodium has greatly influenced the price of cyanide of potassium.

There was an old process, discovered in 1876 or 1877 by Eislenberger, which consisted in fusing dry ferro-cyanide with sodium, but which, for many years, was rendered impracticable by the high price of sodium. Now, thanks to the cheapness of sodium, the manufacture of cyanide is a *fait accompli*. To return to what Mr. Swinburne calls the problems of Castner, I must say that I find very surprising that, a few lines after having declared that he knows nothing of the success of the sodium process, he says: "The price of sodium has been reduced recently by the Castner process, but the extraction of aluminium is still so expensive that electrical methods can compete."

ALUMINIUM.

I am afraid Mr. Swinburne is mistaken when he affirms that aluminium cannot be extracted by ordinary methods. I am told that experiments are conducted at present in London for extracting aluminium from alkaline and earthy alkaline aluminates, and for the simultaneous production of hydroxides of the basic metals contained in the said

aluminates; and it appears that the metal will be produced at a trifling price. Further, it has come to my knowledge that demonstrations will be made in this country before the end of this month of the production of aluminium by direct fusion of bauxite at a price of about 7*d.* or 8*d.* per pound. I am a strong partisan of electrolysis, but in some cases its advantages are *nil*, and I firmly believe that the electric production of aluminium cannot be a commercially paying industry.

There is no problem set in this chapter, but facts and figures only are given.

There are other points to which I might deal to show how Mr. Swinburne is prejudiced and misleading in his views on the electro metallurgy of aluminium.

OZONE.

I would never have expected that ozone would be the object of one of the paragraphs of the "Problems of Commercial Electrolysis."

Ozone generated by silent discharges *is not* and *cannot* possibly be said to be produced electrolytically. Ozone by electrolysis is quite another thing, and we must no more allow Mr. Swinburne to assimilate the transformation of oxygen into ozone by electric effluvia to an electrolytic operation, than a few years ago the chemists allowed Mr. Fahrig to call ozone an electric gas.

FUSED SALT.

This chapter is rather empty, as we cannot attach much importance to the statement that sodium could be used for "making aluminium, for amalgamation in gold extraction, and for making caustic soda by adding water."

As Mr. Swinburne speaks of chloride of sodium boiling a little above its melting point, and of the formation of some subchlorides, which is the theory of Grabau, I am surprised that he neglects to tell us that last year Mr. Grabau was producing 100 kilos. of sodium per day, and is very possibly doing so now.

An electrician of his standing ought to speak respectfully of those who, in spite of their indefatigable researches, left the path open to progress; and the history of the induction coil, of Gaulard's secondary generator, and of the present transformers, must render him more indulgent for the pioneers of the electrolytic art, who did not reap what they had sown. But for Gaulard, is it certain that we would now have the transformers which are now at our disposal?

TIN.

It is to be regretted that Mr. Swinburne does not say more on the recovery of tin from scraps, which, according to him, "can be readily effected." We should have expected to know from him what is the true problem of the separation of tin.

Mr. Swinburne informs us that he does not see how electrolysis can be employed to assist in cleaning plates before tinning, and that he has "examined one of the processes, and it was said to be working very successfully, but found the brushes had been accidentally left off the commutator."

If the brushes were not on the commutator, the only thing to do was to have them put on, so as to be able to form an opinion and to report on the electrolytic process, as compared with the chemical; and people who study the practical pickling of plates by electrolysis will not appreciate much the joke of the brushes. On this, as on many other points, it is impossible to agree with Mr. Swinburne.

"We have improved almost to perfection our plant and machinery," said a tinplate manufacturer to me a little ago; "there is only one thing which we have not been able yet to modify; it is the cleaning of our plates. We still pickle them exactly as 40 years ago, and in the numerous works of Wales we lose every day a large amount of money in consequence of the waste of acid and of the dissolved iron. We rely on electricity to remedy such a state of things, and I am sure electrolysis will allow us to pickle rapidly and cheaply our black plates. As for me," added the manufacturer, "my works are not large, but still I calculate that every week I lose £17 of acid and good wrought annealed rolled iron, which is uselessly dissolved and goes to the river."

ELECTRIC TANNING.

Here at last we have a problem, as Mr. Swinburne declares, "Electrical tanning, though it depends on electrolysis, differs materially from all the processes in not depending on the isolation of radicles at the electrodes." And then he says: "If tannin is an electrolyte, it has a very complex molecule"; and, later on, "If the skins are agitated, and electricity is passed, the agitation circulates the liquid into the interstices, and the electric current *sends the tannin through the walls* of the cells."

If so, is not tannin an electrolyte?

WEBSTER PURIFICATION OF SEWAGE.

It is difficult to understand how Mr. Swinburne has come to the conclusion that the Webster process for electrolytic purification of sewage is not on the same basis as the process found by Hermite (after Webster) for disinfecting ships and ports. Mr. Swinburne ought to know better, as the electrolysis of sewage water has been worked since the last few years, and reports and figures on the results obtained have been published.

This sewage process puzzles Mr. Swinburne, who gravely remarks: "There seems uncertainty as to what the action is supposed to be and why the solid particles should be influenced by the current." The Webster process has been worked long enough to deserve more than this passing criticism; but it looks as if Mr. Swinburne had not taken the trouble of enquiring about the working of any electrolytic process in existence, and simply compiled, commented or summarized, the books of Watt and Gore, and the technical papers on the applications of electrolysis. In spite of what Mr. Swinburne affirms, the basis of the Webster process is that water, and chlorides, which are always present in sewage, are split up into their constituent parts and produce a disinfecting liquid which is nothing more or less than hypochlorous acid, the most powerful known oxidizing agent and an unstable compound, which, having delivered up its oxygen in oxidizing organic matter, changes into hydrochloric acid which neutralizes the alkalinity of the sewage. The hypochlorite of iron (his anodes are made of iron) is acted on by free ammonia, sodium, potassium, and magnesium hydrates, and the ferrous hydrated oxides precipitate the solid matters in suspension. This particular oxide of iron has the property of combining with organic matter and takes up more organic matter than if precipitated chemically. In the electrolytic process, the whole of the matter suspended is carried with the oxide of iron, together with a considerable portion of organic matters.

We all learnt this long ago from Mr. Webster himself, and Mr. Swinburne forgot it, very likely, when writing that the Webster process is not based on the production of hypochlorite

ELECTRO-METALLURGY OF COPPER.

It is to be remarked that Mr. Swinburne, who devotes a great part of his paper to the description of the well known Marchese process, does not say a word about the deposition of copper by Mr. J. W. Swan, at the rate of more than 100 amperes per square foot, and which one of the most prominent metallurgists and scientists not long ago called a national discovery.

This part of the "Problems of Commercial Electrolysis," and especially the paragraph on the cost of refining copper, reminds me of the chapter of the "Electrolytic Separation of Metals," by G. Gore, entitled, "Cost of Electrolytic Refining." Mr. Swinburne is not complimentary to England when he says: "If a new process is brought out it takes ages before it is taken up abroad and still longer before Englishmen will touch it." He ought not, however, to complain, since his Hedgehog transformer has not been long in existence, but is universally known and is applied in many installations in England.

Electricians will also find hard the sentence he passes on them when he says that "chemists are not generally electricians, and electricians are seldom chemists."

WHITE LEAD.

"The improvement of the manufacture of white lead deserves the most careful attention," suggests Mr. Swinburne. "The Dutch process is unhealthy, costly and barbarous."

Electro-chemists have not waited for this warning to manufacture white lead by electricity, and, to quote only one process, the electrolytic production of white lead has been in practical operation for two or three years in America by Turner Bottome.

GOLD AND SILVER.

The electro-separation of gold and silver from their ores, by means of chlorine or other solvent, is not in such a backward state as Mr. Swinburne is inclined to make us believe; it is perhaps only a question of time to see it adopted in all the mining districts where sulphuric acid costs something like one shilling per pound, and the other agents for making chemically chlorine are proportionally expensive. *En passant*, I will say that Mr. Swinburne is not quite right when he criticizes Mr. Crookes, who uses an alternating current for extracting gold. "Unless the current density of the electrolyte is somewhat fabulous," says he, "there can be no current in the small particles of gold." Mr. Swinburne forgets that Mr. Crookes has for object the treatment of refractory ores, and that sulphuretted ores are semi-conductive, and that the pulverized pyrites, agitated in a very weak salt solution, constitute a fairly good electrolyte.

As regards his suggestion of "replacing Mr. Crookes' sodium amalgam by making the mercury itself the cathode;" this has already been applied to the metallurgy of gold. Since the last five years the electric amalgamators are all based on the use of a mercury cathode, and the one which is most known in this country is the B. Molloy apparatus.

Mr. Swinburne seems, however, to believe implicitly in the electrolytic recovery of gold, and to be afraid of seeing gold become a drug, like brass or a base metal, as his last sentence, which was no doubt inspired by an economist, runs: "All improved processes for obtaining precious metals merely enrich some at the expense of others, and reduce the value of the metals. Obtaining gold more easily would be no good to the community, unless it became cheap enough to be used commercially."

ELECTRIC FURNACE.

"Properly speaking, this does not come within the scope of this paper," says Mr. Swinburne, "or there is no reason to suppose that *electrolysis has anything to do with the reduction of the oxides.*"

If so, why does he talk digressively about it in his paper on the "Problems of Commercial Electrolysis."

The same can be said of his comments on the electrical manufacture of phosphorus by the Reademan, Parker and Robinson process; which he describes, although there is no more electrolysis in it than in the production of ozone by silent discharges.

CONCLUSION.

One would expect to find in the conclusion of this paper, which I have briefly reviewed chapter by chapter, the essence, the summing-up of the case of commercial electrolysis; but I must confess that Mr. Swinburne does not conclude anything at all.

There was no demand for such a superficial paper as has been given to the Institution of Electrical Engineers for the discussion of these problems of commercial electrolysis. A scientific society or an academy is not an Areopagus of judges who may solve such or such commercial problems or difficulties, or declare that it is impossible to overcome them. Let Mr. Swinburne solve one of them and he will be welcome when he explains how it was done "commercially," and how he successfully overcame all obstacles; but as long as he has not done so, we hardly see what ground he has for asking the Institution of Electrical Engineers to discuss so widely the present known field of electrolysis.

Where is the electrician who would discuss with him so decisively the problems of applied electro-chemistry? The role of prophet is a dangerous one; on the one hand, it would be unfair to condemn the work of the pioneers of the electrolytic industry because they did not reach perfection at once in applying commercially electrolysis to different industries; on the other, if in the Institution of Electrical Engineers there are members who know that they can solve the problem of, for instance, the production of chlorine and caustic soda, or the economical and rapid electro-separation of metals from their ores, or have found a good unattackable anode, I am positive that they will keep their ideas for themselves and try to make, if not a "fortune," to use Mr. Swinburne's favorite expression, at least money out of their discovery,

We live in a time of inventions and patents, and the electrician who would facilitate the work of his colleagues and competitors, and prepare the way to others by giving publicly at present the explanations wanted for the discussion of the "Problems of Commercial Electrolysis," would be considered very unwise.

Mr. Swinburne has touched almost all the main subjects which are in the province of electrolysis, but this paper is not worthy of him. He has not said anything new; he has not suggested any new direction in the field of electro-chemistry, and he has not laid down any problem at all which a scientific society might "well spend its time" in discussing.

It now remains with me to ask the readers to be indulgent for my faulty English, and Mr. Swinburne to accept my criticism in the spirit in which it was written. Would he have treated me more tenderly if I had attempted to write a paper on the "Problems of Commercial Transformers"?

FIG. 2.—VIEW AT THE AMERICAN INSTITUTE, N. Y.—BOOTH DEVOTED TO ENGRAVING ON GLASS BY ELECTRICITY.

Engraving on Glass by Electricity.

Quite a novel application of electricity to the ornamenting of glass-ware is being exhibited at the present time at the American Institute Fair. The apparatus is the invention of Dr. A. H. Phelps, of Glens Falls, N. Y., who calls the process Electro-Thermogravure. It is the application of an old device to a new use. The tool used for engraving upon glass is shown in Fig. 1, (first page) and consists of a brass tube A, lightly packed with shredded asbestos and through which pass two conductors which terminate in two binding posts, *c, c.* Projecting from the end of the brass tube is a pointed piece of slate D, against which rests a piece of No. 18 B. & S. platinum wire B, whose ends are fastened to the binding posts. Through the large tube is a smaller brass tube E, extending to the bottom, which permits of a flow of cool water, which goes through the handle and passes off through another tube F. A current of 50 amperes and 5 volts is sent through the platinum wire, which is heated to white incandescence. The pointed slate pencil supports the wire and permits of a moderate pressure being applied to the point without injuring the wire. The operator holds in one hand the object to be engraved upon, generally some piece of ornamental copper-flashed glass-ware, and in the other hand, the tool with which he writes. The film of red colored glass upon the outside is so thin that the least scratch will expose clear glass and all marks thus made upon the surface stand out transparent against a red ground.

The principle upon which it works is as follows: The heated platinum wire as it touches the glass causes the part immediately underneath it to expand and chip off from the body. As the wire is passed over the surface rather quickly, the chips are very minute and present under the microscope a peculiar appearance, being triangular in shape and curved on the surface. Some of these chips, as they fly from the glass, are melted by the incandescent platinum wire, and as the tool is lifted, fine fibres of glass are drawn out, which are removed from the work by scraping the surface of the glass with a piece of sheet copper.

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THE OPINION OF AN AUTHORITY:

"The editorials appearing in ELECTRICAL REVIEW have been of untold value to all electrical enterprises."

A. M. YOUNG.

In this number is started a series of interesting articles on electric railways, from the practical pen of T. J. McTighe. They will no doubt prove interesting to those who have the subject at heart, and to whom the latest improvements and developments in electric railways are of importance. Mr. McTighe is a consulting electrical engineer of well-known ability, and he gives what is no doubt the result of well earned experience. His article in this issue is followed by an interesting discussion on the report of the committee on "A Model Electric Railway Road-bed and Underground Wiring," treating of the same topic, namely, the "Return Circuit."

It does not pay to abuse the telephone operator in Austria. Recently, in Vienna, a merchant who was in considerable hurry at the time called up "central," but, owing to a block in the line, he was temporarily detained at the telephone. Without waiting to determine the cause, he vented his ire, forgetting that he had not hung up the receiver, and that the operator could hear him. A day or two afterwards the merchant received a summons for having used "abusive and defamatory language" respecting the young lady, and on the case being brought before the court he was fined $50.

A special application of the electric light for the cure of various rheumatic and neuralgic affections is being advocated by Professor von Stein, of Moscow. His method is to apply a small incandescent lamp with a funnel shaped reflector to the part affected. Except on the head and neck, the lamp is left until the patient begins to complain of the heat, generally from one to five minutes. This treatment is said to have been successful in cases of lumbago, and is a modification of one adopted by an American physician who has employed sunlight as a curative agent, using concentrated rays for special affections.

The Swiss telephone system is claimed to be the best and cheapest in Europe. It is now under government control. The first telephone was used at Zurich, in 1880, when a private company started with 144 telephones. In 1886 the government undertook the working of the system, and the number of subscribers increased to 1,000. In this year the net profits were over 130,000 francs. In 1890 the subscribers numbered 8,000. On an average there were 546 calls a year to each telephone. The government allows 800 calls to each subscriber without extra charge, and all calls beyond that number are charged for at one cent each. The usual charge to subscribers is $24 the first year, $20 for the second year, and less than $16 per year from then on. Telegrams are received at the telephone office and delivered to the telegraph department at two cents each.

THE COMET.

It seems that the stray comet which is now visible as a prominent luminary in the heavens, second only to "Pale Luna, silvery queen of night," is not destined to leave us without being connected in some way with the far-reaching science of electricity. Our earthquake prophet, Wiggins, has extended his predictions into the realms of space, and has boldly declared that the electrical condition of the comet is similar to that of the earth, and, therefore, since like electricities repel, taking into consideration the immense charges held by both our earth and the comet, we need have no fear of a collision. The residents of the comet, if such there be, will pass us safely by; and the comet will continue in its erratic career, while the earth keeps on revolving in its usual quiet way to the music of the spheres.

THE NEXT CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

The sixteenth convention of The National Electric Light Association will be held in the Bell Telephone Building, in St. Louis, Mo., on February 28th, March 1st and 2d, 1893. If we may be allowed to venture upon a prediction, we would say that there is every reason to believe that this meeting will be as successful as any heretofore held, and matters will be brought up and papers read that will interest all and prove of great benefit to those who undertake the trip to St. Louis. The hospitable people of St. Louis, which is also the home of President J. I. Ayer of the Association, will cordially welcome the visiting electrical workers. President Ayer is devoting much time and energy to the arrangements for the meeting, and a valuable, enjoyable and instructive programme may be expected.

THE NEW ELECTRIC ROADS IN BROOKLYN.

The rivalry now in course of progress between New York city and Brooklyn, with the purpose of abolishing the barbarous horse traction in use on the street railways, and superseding it by mechanical power, offers an instructive object lesson for New Yorkers, who, by simply crossing the bridge, will become convinced that Brooklyn has made the wiser choice between two good systems. New York has for many months been occupied with digging up Broadway, Second avenue, the Bowery and Third avenue, to lay the foundations of a cable track with railways and tunnels. The promoters bought expensive real estate on Broadway and on the Bowery, and are there erecting large buildings to contain the power plant, consisting of boilers and steam engines with their attachments of huge wheels to propel cables of 12 and 16 miles, respectively, in length. They began many months ago and there is no certainty when they will have the cables in operation.

Brooklyn began about as many weeks ago as New York began months ago, and adopted in place of a cable tunnel a simple wire stretched overhead to furnish the current, by means of the well-known trolley, to the electric motor under the floor of the car. About six weeks ago the cross town line of Smith street was running; last week the Third avenue line was completed, and now the Myrtle avenue line is being constructed, all these lines passing the bridge entrance and extending to Fulton Ferry.

They laid also new, improved and heavier rails, with special regard to make secure for the return current by connecting every single rail with one wire laid under the pavement between the rails, so as not to depend on the ground connection alone.

We recommend New Yorkers who visit Brooklyn to see the electric traction not to neglect to make, also, a visit to the cable-machinery of the bridge, and compare the huge engines and boiler house required to drive a cable of scarcely one mile in length with the overhead trolley wire, simply connected with the dynamo plant, which does not take one-quarter of the space of the steam engines, costs not one-tenth of the money, and makes not one-hundredth part of the noise. A visitor will see here a most favorable illustration of the comparative value of electric traction over direct steam traction, and may obtain some idea of the immense engines which will have to be erected in New York to drive cables of 10 to 20 times the length of the bridge cable.

ELECTRIC TRACTION ON FIFTH AVENUE.

The time has come when people in the advancing stage, as we are in New York, should not be obliged to submit to the horse car and omnibus nuisances. In Glasgow, omnibuses are provided with pneumatic tires and in London, storage batteries constitute the motive power of another line. A combination of these two appliances if attached to an elegantly upholstered omnibus, which could travel over asphalt pavement, would be a most happy relief from the unceasing and agonizing jolting of the present stages that infest Fifth avenue. When some brilliant mind invents a cheaper tire that will resist heavy weights and will not rot like the present air-inflated rubber cushion, we may hope to see this improvement realized.

M. Lippman has not rested on the laurels he has won in color photography. It is said that some of his latest experiments are quite interesting and beautiful. He has obtained most brilliant photographs upon films of albumino-bromide of silver rendered orthochromatic by azaline and cyanine. All the colors came out at once, even the red, without the usual interposition of colored screens, and after exposures varying from five to 30 seconds. Among other illustrations recently made in color photography, M. Lippman has submitted pictures of stained glass windows, draperies, oranges and vari-colored birds, taken by electric light, with five to ten minutes' exposure, in which the color as well as the form is clearly defined.

CORRESPONDENCE.

OUR CHICAGO LETTER.

Mr. Edward R. Grier, late of Philadelphia, is now at 1522 Monadnock building, where he is handling the Russell switches.

Mr. W. A. Foote, the general manager of the lighting plants at Battle Creek and Kalamazoo paid Chicago a little visit last week.

George Cutter has just sent a batch of lamp-hour recorders to Greece, where arc lamp meters are needed just as much as in this country.

Pass & Seymour, of Syracuse, have placed their Western territory in the hands of George Cutter, who will carry a full line of their goods at Chicago.

Fred. DeLand has accepted a position as resident World's Fair correspondent of the *Scientific American*. His many friends wish him all success possible.

The Sioux City and Leeds Railway, Sioux City, Ia., which was recently equipped with electricity by the Detroit Electrical Works, is now in full operation, and is one of the best equipped roads in the West.

W. W. Nichols, superintendent of telephones for the Chicago Telephone Company, has resigned his position on account of ill-health, and will leave the city. Superintendent C. H. Wilson is now away on a month's leave of absence.

W. R. Mason, of the Railway Equipment Company, reports a big business during the past week in railway supplies. They are now figuring on some large contracts which will be closed soon, and the prospect for a good winter trade is assured.

Fred. DeLand, late with the *Electrical World*, will address the Chicago Electrical Association on November 29, on "Water, Light and Power at the World's Fair." D. H. Ogden, business manager of the *Western Electrician*, has resigned to accept the position of Western representative of the *Electrical World*, New York. M. J. B.

Chicago, November 26.

OUR CANADA LETTER.

Toronto, Que.—The city engineer has been asked to allow a line of electric railway to run through the Queen's Park, from Queen street north to the northern limit of the city.

Niagara Falls, Ont.—Mr. W. A. Grant, late secretary to Mr. Van Horne, president of the Canadian Pacific Railway Company, has been appointed manager of the Niagara Falls Electrical Railway Company.

Winnipeg, Man.—The first trolley car accident on the new electric street railway lines now operating on the streets of this city occurred November 18, resulting in the death of Aaron Kilpatrick, an old citizen of Winnipeg.

Montreal, Que.—Mr. Nelson Grayburn, of the engineering department of the (Edison) Canadian General Electrical Company, of Toronto, Ont., was in Montreal last week with three new electric cars from their works, which were put on St. Catherine street line. These cars are even handsomer than the previous ones brought here by the Edison company. On one of these there is an innovation, the heating being done by electricity, placed under the seats so that it is perfectly safe, the power coming from the trolley wire.—During the past week another Edison generator of 300 horse power has been placed in the Royal electric power house, to develop power for the trolley system. This generator will be started next week. Another new generator has been ordered to be placed on Mount Royal avenue.

Ottawa, Ont.—A local electrician is said to have discovered a process for utilizing the electricity passing over the wires for light, power and heating purposes, so as to withdraw the heat from cast iron blocks until reduced to the temperature of ice, and then using them in place of natural ice. It is claimed this can be done at a price to compete favorably with ice.—Notice is given that application will be made to the Parliament of Canada next session for an act to incorporate the "Automatic Telephone and Electric Co., of Canada," with power to manufacture, deal in and operate telephone instruments, switches and connections, and to manufacture, operate and deal in electrical instruments and appliances, and to carry on a general electrical supply, operating and manufacturing business, with a head office in Montreal, Que. J. A. C.

Montreal, November 26.

LETTERS FROM A LABORATORY.—XXIII.

BY JULIAN A. MOSES.

There are numerous little difficulties that beset the path of the electroplater and electrotyper which can only be overcome by constant experimenting, entailing considerable loss of time and money upon the practical worker. It is often that the experimenter is called in and, with his theoretical knowledge, combined with the practical experience of the workman, results are obtained which sometimes prove of great value alike to them and to the public.

An electrotyper came into my laboratory the other day and asked me to try to overcome the difficulty which was as follows: His silver solutions would "freeze," *i. e.*, crystals would form upon the surfaces of the liquids. This happened oftener when the baths were not in use; but even with the solutions that he employed continually, this film of crystals would form and deposit on the bottom of the tank.

While it is true that the work turned out by this firm is as near perfect as possible, this little difficulty was annoying to him and he was desirous of avoiding it. As it is possible that the solutions of other electrotypers are in the same condition, it is likely that they will be interested in knowing how this fault was obviated. His solutions were very concentrated, and any alterations in the amount of distilled water used as a solvent would correspondingly affect the solution, so that the addition of a little more potassium cyanide solution to the bath immediately redissolved the precipitated crystals and made the bath as clear as it was before. However, a stove should be kept in the plating room so as to keep the temperature as even as possible. It is probable that this crystallization may occur as a result of other causes, but it is advisable to narrow the field and make sure of one particular cause.

I have no doubt but that a few practical "don'ts" about the care of silver solutions will prove quite acceptable.

Don't put any piece of work coated with plumbago into the bath without first washing it thoroughly under a moderately strong flow of water, and dipping it in a jar containing a solution of potassium cyanide. If this is not done the finely powdered plumbago will float to the top, and it will be impossible to keep objects perfectly clean in the bath. As soon as anything touches the surface of the solution, if any plumbago is present, it will receive a coating which will immediately adhere to it, thus preventing a clean deposit.

Don't put anything into the solutions that may dissolve in them. When the objects are small, dip them first into a small battery jar filled with some plating solution, and leave them there awhile until you are sure that they will not cause any harm to the bath. By observing this precaution you will never need to precipitate the silver in the form of the chloride, and be obliged to make the bath anew, thus losing all the cyanide.

Don't try any experiments in the large bath, as it is difficult to tell how minute may be the foreign matter which is liable to spoil the bath.

Don't have any copper in your anodes. Be sure that they are pure silver. Any copper in the solution will tend to give an irregular deposit.

Don't let any of your solution splash out upon the brass or copper bars which hold your anodes and cathodes in the solution. It would be better to silver-plate them before permitting them to rest over the bath.

Don't put anything into the bath without being sure that the current is turned on. Attach your conducting wires to the article *before* inserting into the bath, and then plunge it in immediately, taking care that all adhering bubbles of air are removed. Above all, don't get the poles reversed.

Don't use anything but pure silver conductors in the bath, and be sure that they are large enough to safely conduct the current.

Don't agitate the solution in any way, as there is sometimes a fine impalpable powder which settles to the bottom, and which, upon the least movement of the solution, rises in clouds and covers the work. It is not necessary to filter this off, as it is perfectly harmless if left alone.

Don't filter the bath more than once in about six months.

Don't give flies a chance to sink to the bottom of the bath, if they insist on dying in the solution, as their bodies sometimes rise to the surface and you obtain a beautiful reproduction of them in silver upon your work, perhaps some special piece for which you are in a great hurry.

Don't try to get perfectly even deposits from a dynamo. While it is possible, it is more satisfactory to use storage batteries and thus be sure that you will obtain perfect results.

Don't have your rheostat in an unhandy place; put it on the side of the tank, so that you may be able to watch your deposit and control the current at the same time.

Don't have copper-plating solutions in the neighborhood of the silver bath.

Don't dip articles in nitric acid and then put them into the bath without first washing them in water and immersing them in a solution of potassium cyanide.

Music for the Phonograph.

All day long the sounds of music issue from the rear windows of the central house in the block on the east side of Fifth avenue, between Twenty-eighth and Twenty-ninth streets, says the New York *Sun*. These sounds are not such as come from the piano when the latter is under the spell of my lady's fingers, or from the guitar or violin or any other instrument that is appropriate to individual entertainment. They are of different kinds, both vocal and instrumental. Sometimes they emanate from a chorus, sometimes from two voices only, and sometimes from one. Brass bands and string orchestras contribute. The sounds are always very loud and can be heard for blocks around. Sometimes the music is accompanied by oratory. The people who occupy the houses on the same block and also those in the houses which form the square to the eastward can hear all plainly. The sounds affect these people variously. Some seem to be much annoyed and keep their windows closed most of the time. Others seem to enjoy it, and sit at open windows or even go out into the rear yards to hear more plainly. The servants seem to enjoy it particularly, and probably many a household duty is neglected while they stop to listen.

If one were to enter the house whence the noises come, he would find that the music and oratory are all due to Mr. Edison's invention of the phonograph, and the sounds are intended to be recorded indelibly upon the little wax rolls contained in phonographic instruments. The popular songs, orations of great speakers, and all the other entertaining and instructive sounds which are duplicated on the phonograph originate here. The company which puts the phonographs in the hotels and other public places throughout the country must constantly provide new rolls containing the latest instrumental music, songs and speeches, and, therefore, musicians and orators are kept busy every day introducing them into the machine.

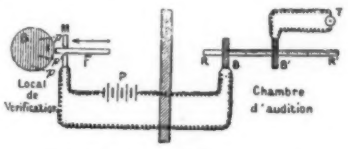
PERSONAL.

Mr. J. E. Ham, an experienced and industrious member of General Manager Brixey's staff of hardworkers for the Kerite Company, was recently very properly honored by appointment as special agent. Mr. Ham's first knowledge of his new responsibilities came to him on his return from a brief business trip, when he found his name and new title emblazoned on the office door. The REVIEW congratulates both General Manager Brixey and Mr. Ham.

An Electrical Detector.

THE SCHISEOPHONE OF CAPTAIN DE PLACE, OF PARIS.

At the last meeting of the "Academie des Sciences de Paris," October 24, 1892, Captain De Place showed and explained his new apparatus, constructed for the detection of flaws or cracks in metal pieces. In the schematic drawing presented herewith, it will be seen that the hammer or striking rod F passes through the microphone to strike against the block of metal under test. In a separate room is a sonometre consisting of the graduated scale R R^1 upon which slide the coils B B^1; the latter being connected to the telephone T. The battery or source of electricity is, of course, in the microphone circuit. The striker F consists of a thin hardened steel rod to which an up and down motion is given either by a clock-work or



THE DE PLACE SCHISEOPHONE.

manually. The striker should not be driven too fast, three blows per second being amply sufficient for testing purposes. The steel rod traverses the center of the microphone, which, in its turn, is carried on a shaft by means of which the distance between the microphone and the metal under test may quickly be adjusted. The microphone is of the well known Crossley type, and the battery consists of two Leclanche elements in series to which a pole changer is added to prevent polarization. The only novelty in these batteries is the replacement of the ammonium chloride solution by a compound substance, Melasine, recently invented by M. de Place.

The sonometre with its graduated scale rod carries two coils, of which one is stationary at zero, having a resistance of 125 ohms. This bobbin is in the microphone and battery circuit, while the second, a movable coil of equal resistance, is connected to the telephone.

As soon as a preconcerted signal is heard, the operator who desires to test a given piece of metal approaches it to the instrument. In an adjacent room another operator, who wears a head gear to which two small telephone receivers are attached, listens to the noise produced in the receivers, adjusting the movable coil on the graduated scale until there is silence, or a scarcely perceptible sound. If the object under test is perfect, the sound remains the same while the striker of the schiseophone is moved along its surface; on the other hand the slightest flaw or unequality in the metal is perceived by a sudden change in the volume of the received sound.

This instrument has been adopted by the French Government for the testing of armor plates and projectiles, and there is no doubt that it will be found useful for many other industrial purposes.

Queer Effects of Electrical Engraving.

In the art of engraving on glass by means of electricity, described elsewhere in this issue, different kinds of handles for the tool have been tried, but as yet none have been found that were made of sufficiently good nonconducting material to prevent the heat from burning the hand of the operator. The present form, as described, is kept cool by a flow of water through the handle. A simple siphon device is sufficient to conduct away all of the heat. Portraits of Mrs. Harrison and of Columbus, and a picture of the recent naval parade, may be seen at the stand and they speak well for the rapid skill of the operator. The process has not as yet reached further than the ornamental stage, although it is probable that it can be put to good use for engraving upon stones, some of which it affects in a rather peculiar manner. Marks made by it upon cats-eye are dark, almost as if ink were used, and upon carnelian, places passed over by the incandescent wire retain a dark maroon appearance.

ELECTRICAL EXHIBITORS.

NAMES OF ENTERPRISING COMPANIES THAT WILL EXHIBIT AT THE WORLD'S FAIR.

We publish below a complete list of names of electrical houses that will exhibit at the World's Fair next year. This will be a valuable reference list, and should be preserved by every one interested:

American Bell Telephone Co., 125 Milk street, Boston; Anthony Electric Instrument Co., 9 Metropolitan block, Chicago; Arnold Electric Mfg. Co., Chester, Pa.; American Exhibition Co., *Ledger* building, Philadelphia, Pa.; American Graphophone Co., 619 Fourteenth street, Washington, D. C.; Adler, Leon D., 11 Sidney place, Newark, N. J.; Akron Electric Mfg. Co., Akron, O.; American Tanning Co., 46 Wall street, New York city; *Amateur Electrician*, Ravenswood, Ill.

Bain Electric Mfg. Co., 47 S. Jefferson street, Chicago; Brooks, R. T., 82 John street, New York city; Brooks, John C., Paterson, N. J.; Brush Electric Co., Cleveland, O.; Bryan, Enholm & Co., 136 Liberty street, New York city; Billings & Spencer Co., Hartford, Conn.; Belknap Motor Co., Portland, Me.; Bottome, Turner D., Hoosick, N. Y.; Berliner, E., Columbia Road, Washington, D. C.; Brady, T. H., New Britain, Conn.; Barton Bell Co., Marion, Ind.; Blodgett Mfg. Co., 1602 Ashland block, Chicago; Butler Hard Rubber Co., 33 Mercer street, New York city; Beacon Vacuum Pump and Electric Co., Irvington street, Boston.

"C. & C." Electric Motor Co., 402 Greenwich street, New York city; Cutter, George, 333 "The Rookery." Chicago; Crocker-Wheeler Electric Co., 430 West Fourteenth street, New York city; Consolidated Electric Storage Co., Drexel building, Philadelphia, Pa.; Commercial Cable Co., 1 Broadway, New York city; Cook, Victor A., 135 Dearborn avenue, Chicago; Chicago Electric Wire Co. of Wilmington, Wilmington, Del.; Chicago Society of Operative Electricians, 1303 Chamber of Commerce building, Chicago; Chicago Magnetic Shield Co., 6 Central Music Hall, Chicago; Commercial Electric Co., Indianapolis, Ind.; Columbia Incandescent Lamp Co., 1912 Olive street, St. Louis, Mo.; Central Electric Co., 115 Franklin street, Chicago; Cross, Frank, Washington, Ind.; Cregier, Dewitt C., Jr., 418 East Chicago avenue, Chicago.

Davy Electric Belt and Appliance Co., Evansville, Wis.; Duplex Electric Co., Corry, Pa.; Dayton Fan and Motor Co., Dayton, O.; Devey, Matthew H., 253 Parker street, Chester, Pa.; DuLaney Clock Co., 79 Dearborn street, Chicago; Detroit Electrical Works, Detroit, Mich.; Day, S. A., 166 Fulton street, New York city; Delaware Hard Fibre Co., Wilmington, Del.

ELECTRICAL REVIEW, 13 Park Row, New York city; Electric Merchandise Co., 11 Adams street, Chicago; Electrical Supply Co., 171 Randolph street, Chicago; *Electrical World*, Times Building, New York city; Eureka Electric Co., 18 Broadway, New York city; Elgin Telephone Co., Elgin, Ill; Empire Gold and Silver Plating Works, 75 Nassau street, New York city; Engineering Equipment Co., 143 Liberty street, New York city; Eureka Tempered Copper Co., North East, Erie County, Pa.; Electrical Industries Publishing Co., Monadnock building, Chicago; Edgerton, N. H. 609 Commercial street, Philadelphia, Pa.; Electric Gas Lighting Co., 20 Lakeside building, Chicago; Electrical Forging Co., 163 Oliver street, Boston; *Electrical Engineer*, 203 Broadway, New York city; Electricity Newspaper Co., 6 Park Place, New York city; Electric Secret Service Co., 45 Broadway, New York city; Electric Eng. and Supply Co., Syracuse, N. Y.; Electric Heat Alarm Co., 113 Devonshire street, Boston; Eddy Electric Mfg. Co., Windsor, Conn.; Electric Advertising & Display Mfg. Co., 134 South Seventh street, Philadelphia, Pa.; Electric Machine Co., 1008 Title and Trust building, Chicago; Electric Appliance Co., 242 Madison street, Chicago; Excelsior Electric Co., 42 Broad street, New York city; Egan, Chas. E., Englewood, Ill.; Empire China Works, 144 Green street, Brooklyn, N. Y.; *Electrical Age* Publishing Co., *World* building, New York city; Electro Medical Battery Co., 128 Main street, Kalamazoo, Mich.; Edgerton, E. M., 301 Sixty-third street, Chicago; Electrolibration Co., Birmingham, Ala.; Edison, Thos. A., Orange, N. J.

Field Engineering Co., 143 Liberty street, New York city; Fibre Pipe Co., Mechanicsville, N. Y.; Fort Wayne Electric Co., Fort Wayne, Ind.; Ford-Washburn Storelectro Co., Cleveland, O.; Franklin Electric Appliance Co., 141 Milk street, Boston; French, H. W., & John Warren, 833 Exchange building, Boston.

Guillaume, Alfred, 215 Dearborn street, Chicago; Gray, Elisha, Highland Park, Ill.; Greeley, The E. S., & Co., 567 Dey street, New York city; Goodwin, F. O., Fifty-third and Wyalusing avenue, Philadelphia, Pa.; General Electric Co., New York and Boston; Gamewell Fire Alarm Telegraph Co., 901 Ashland block, Chicago; Germania Electric Co., 620 Atlantic avenue, Boston; Great Western Electric Supply Co., 195 S. Canal street, Chicago.

Hanson & Van Winkle Electric Co., 35 and 37 South Canal street, Chicago; Heisler Electric Co., Drexel building, Philadelphia; Hirlimann, Charles J., 117 MacDougal street, New York city; Hornell Iron Works, Hornellsville, N. Y.; Hall, Charles Fred., New Grand Hotel, Plymouth place, Chicago; Huestis, Charles D. C., Ft. Wayne, Ind.; Holmes, Nathaniel L., Delta Upsilon House, Ann Arbor, Mich.; Houlehan, James, 49 North Clark street, Chicago; Hope Electric Appliance Co., Providence, R. I.

Interior Conduit and Insulation Co., 42 Broad street, New York city; India Rubber Comb Co., 9 Mercer street, New York city; International Electric Railway Co., Commerce Building, Chicago; Illinois Alloy Co., 41 Portland block, Chicago; Indiana Insulated Wire and Rubber Co., Jonesboro, Ind.

Jenney Electric Motor Co., Indianapolis, Ind.; John's Mfg. Co., H. W., 87 Maiden lane, New York city; Johnson Electric Co., Cleveland, O.

Kirwan Electric Indicator Co., Wilkesbarre, Pa.; K. A. P. Electric Novelty Co., S. Second street, La Crosse, Wis.

Lang, J., & Co., 44 Michigan street, Chicago; La Roche Electric Works, 116 N. Sixth street, Philadelphia, Pa.; Le Clanche Battery Co., 111 E. One Hundred and Thirty-first street, New York city; Leatheroid Mfg. Co., Kennebunk, Me.

McIntire Co., C., 13 Franklin street, Newark, N. J.; Munson Lightning Conductor Co., Indianapolis, Ind.; Marcus, Wm. N., 218 N. Second street, Philadelphia, Pa.; Moore, Alfred F., 200 N. Third street, Philadelphia, Pa.; Mather Electric Co., 9 Metropolitan block, Chicago; Mather, A. C., 169 Adams street, Chicago; Munson Belting Co., 36 S. Canal street, Chicago; Municipal Fire and Police Telegraph, Highlands, Mass.; Mason, Jas. H., 120 Park avenue, Brooklyn, N. Y.; McCaskey, Alfred S., & J. A. Ellis, Union Club, Chicago; Manhattan Electric Supply Co., 36 Cortlandt street, New York city.

New York Insulated Wire Co., 15 Cortlandt street, New York city; National Electric Mfg. Co., Eau Claire, Wis.; Newman Clock Mfg. Co., 134 Van Buren street, Chicago; Norwich Insulated Wire Co., 112 Greene street, New York city; New England Butt Co., Providence, R. I.; North American Electrical Co., 14 Ann street, New York city; New York and London Electric Association, 1021 Main street, Kansas City, Mo.; National Carbon Co., Cleveland, O.

Owen, Dr. A., 201 State street, Chicago.

Perkins, Frank C., 103 E. State street, Ithaca, N. Y.; Paiste, H. C., 1201 Market street, Philadelphia, Pa.; Page Belting Co., 165 Lake street, Chicago; Pumpelly, Jas. K., 205 S. Canal street, Chicago; Pennock Battery, Electric Light and Improvement Co., 324 Dearborn street, Chicago; Perkins Electric Lamp Co., Metropolitan block, Chicago; Phœnix Glass Co., 43 Sixth avenue, Pittsburgh, Pa.; Praul Rotary Steam Engine Co., 216 S. Seventh street, Philadelphia, Pa.; Phelps, A. H., M. D., Glens Falls, N. Y.; Wm. Powell Co., Spring Grove avenue, Cincinnati; Perry & Runlett, 25 Stickney street, West Lynn, Mass.; Pulvarmacher Galvanic Co., Cincinnati, O.; Pratt Electro-Medical Supply Co., 75 Madison street, Chicago.

Quin, J. B., 521 Fifth avenue, Louisville, Ky.; Quinby, Wm. C., 326 Pine street, San Francisco, Cal.; Queen & Co., James W., 924 Chestnut street, Philadelphia, Pa.

Railway Equipment Co., 11 Adams street, Chicago; Revell, Alex., Wabash avenue and Adams street, Chicago; Rich, Charles Clayton, Mt. Vernon, N. Y. (Rich Electric Heating Co.); Rogers, J. Harris, Bladensburg, Md.; Ries Electric Specialty Co., Eutaw and Baltimore streets, Baltimore, Md.; Roessler & Hasslacher Chemical Co., 73 Pine street, New York city; Rauscher, John, 134 Concord street, West St. Paul, Minn.; Robinson Machine Co., Altoona, Pa.; Ringler, F. A. & Co., 21 Barclay street, New York city; Riker Electrical Motor Co., 45 York street, Brooklyn; Ries, Elias E., corner Baltimore and Eutaw streets, Baltimore, Md.; Rosseau's Electric Works, 310 Mott avenue, New York city.

Sperry Electric Mining Machine Co., Thirty-ninth street and Stewart avenue, city; Standard Underground Cable Co., Westinghouse Building, Pittsburgh, Pa.; Sponholz, Carl L., 126 School street, Lowell, Mass.; Short Electric Railway Co., Cleveland, O.; Swan Lamp Mfg Co., Cleveland, O.; Standard Paint Co., 2 Liberty street, New York city; Striemer, A., Hayward, Wis.; Sigler, James O., Paterson, Passaic Co., N. J.; Steward Mfg. Co., D. M., Chattanooga, Tenn.; Strowger Automatic Telephone Exchange, 501 The Rookery, Chicago; Sample, H. C., 145 Ontario street, Chicago; Sarony, H. J., 4 Liberty Square, Boston; Stanley Electric Mfg. Co., Pittsfield, Mass.; Schieren, Charles A. & Co., 46 South Canal street, Chicago; Standard Electric Signal Co., Rochester, N. Y.; Short Electric Railway Co., Cleveland, O.; Standard Battery Co., 324 Dearborn street, Chicago; Sanden Electric Co., 169 La Salle street, Chicago; Stoelting, Christ. H., 62 South Canal street, Chicago.

Thermo Electric Heat Regulating Co., Easton, Pa.; Thomson-Houston Electric Co., Lynn, Mass.; Ticonderoga Machine Co., Ticonderoga, N. Y.; Thomson Electric Welding Co., Fiske Building, Boston; Todd, John T., Newman, Ill.; Thompson & Robertson, 258 Broadway, New York city; Tompkins, Mrs. Jennie E., 2408 Wabash avenue, Chicago; Tropical American Telegraph Co., 15 Cortlandt street, New York city; Tate, 209 West Van Buren street, Chicago.

Utica Electric Mfg. and Supply Co., Utica, N. Y.; Union Electric Works, 207 South Canal street, Chicago.

Vetter, J. C. & Co., 214 East Forty-seventh street, New York city; Vail, Stephen, 18 Cortlandt street, New York city; Viaduct Mfg. Co., German and Charles streets, Baltimore, Md.

Western Electric Co., 327 Clinton street, Chicago; Weston, Wm. H. & Co., 330 Filbert street, Philadelphia, Pa.; Writing Tel. Co., P. O. 1322, New York city; Washburn & Moen Mfg. Co., Worcester, Mass. Waterhouse Bros., 302 Asylum street, Hartford, Conn.; *Western Electrician*, 6 Lakeside building, Chicago; Weston Electrical Instrument Co., 114 William street, Newark, N. J.; Westinghouse Electric Mfg. Co., Pittsburgh, Pa.; Western Union Telegraph Co., Chicago; Wing, L. J., 126 Liberty street, New York city; Waddell-Entz Co., Bridgeport, Conn.; Webb, Dr. G. F., 251 The Arcade, Cleveland, O.; Wiesinfeld, Robt. S., 2 South Holiday street, Baltimore, Md.; Woods, Granville T., 136 Liberty street, New York city.

Zuker & Levett Chemical Co., 40 Murray street, New York city.

Extracting the Kernel from the Franchise.

The common council of Bridgeport, Conn., evidently think that a franchise in their city is a most valuable thing. They fix the fare to be charged and retain the right to exact a part of the gross or net receipts of the company for the franchise granted; also the right to alter or amend the manner of propelling the cars; and it was resolved at a recent meeting that it was the opinion of the court of common council that it was granting a most valuable franchise, for which the company ought to compensate the city in the near future.

ELECTRIC LIGHT FLASHES.

A novel electric lamp is one in the form of a hen sitting on a nest of luminous eggs.

Lansing, Mich., has purchased and now owns an electric light plant of its own, which it is claimed earns $8,000 a year, net.

The Hartford Light and Power Company has placed a mortgage of $150,000 on its entire plant. The money is for improvements and extension.

The celebrated high electric light mast at Minneapolis, which is 257 feet high, has proved ineffectual for lighting purposes and is now no longer used.

Another phase of the "penny-in-the-slot" principle will be welcomed by railroad travelers in London who will be able to obtain half an hour's light for two cents.

The Edison Electric Light Company has been authorized in Kentucky to string its wires for commercial purposes upon the poles erected by other lines for public purposes.

The Westinghouse Electric and Manufacturing Company has opened its new shop in Alleghany City, Pa. All the World's Fair apparatus will be manufactured here. About 500 men will be employed at first.

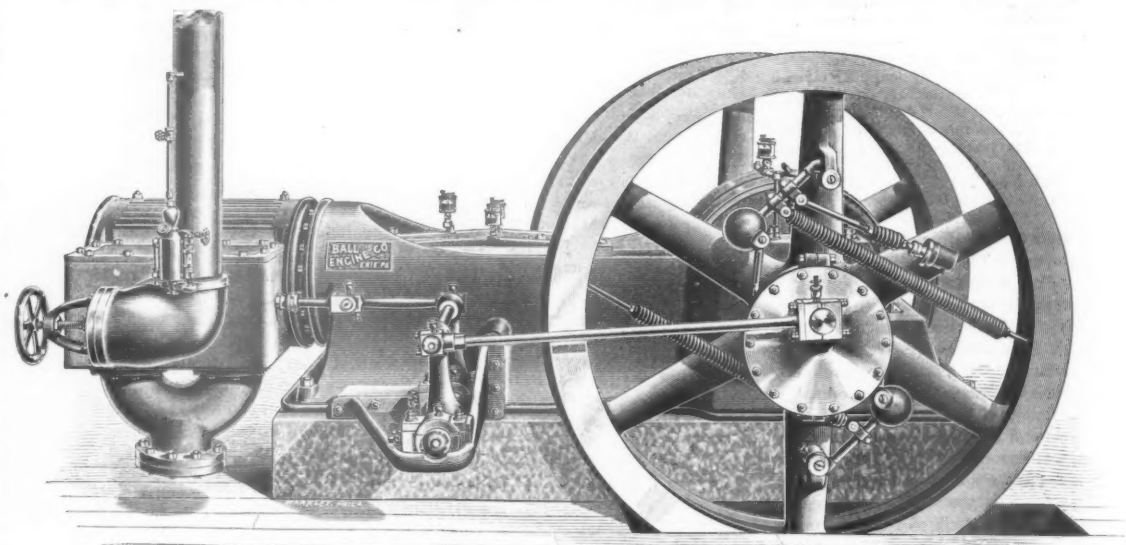
The original plans for the electric lighting at the World's Fair called for 100,000 incandescent lamps. It has already been found necessary twice to increase the number, and according to latest reports 300,000 lamps will be required.

At a recent meeting of the United States Electric Lighting Company, of Washington, D. C., reports were made by the officers showing that during the last year there had been an increase of 85 per cent. in the business of the company.

Recent investigations as to the quantity of light transmitted by plain, ribbed and rough glass show that white plain glass arrests seven or eight per cent., and light ribbed glass 12 per cent. Plain glass enables the rays to pour through in a direct line, causing heavy shadows, while with the ribbed glass the diffusion of light is equal throughout the entire room. This ribbed glass might be used for the bulbs of incandescent lamps, thus furnishing the dispersed light so generally required.

The large fire-proof pattern building at the river works of the Thomson-Houston Company, at Lynn, Mass., having been completed, the transferring of patterns from the old quarters at the Center street works has been commenced. The company has purchased the building on Berkeley street, in the rear of the West Iron Works, and will use it as a storehouse for apparatus, stock, etc.

Another big electric locomotive is soon to be given a practical test at the Thomson-Houston Works; it is at present in factory K, and in about a week or ten days it will be tested outside of the factories in West Lynn, where a special trolley has been erected for it. This is only one of many electric locomotives that are soon to be constructed.



A NEW ENGINE FOR ELECTRIC RAILWAY WORK.

New Heavy Duty Electric Railway Engine.

In selecting an engine for electric railway service the character of its duties should always be carefully considered. It will be found that the work is very exacting and severe, and the engine should be adapted for heavy duty, varying load, and long continuous runs. It should, therefore, have great weight and strength, with sufficient metal so distributed as to receive the various strains and thrusts of moving parts without deflection or vibration.

The engine shown in the illustration was designed by the Ball Engine Company, especially for electric railways and electric welding, and possesses the above requirements to an admirable degree, as may be seen by the view and description following:

The frame of the engine is massive and heavy, and internally ribbed so as to give the greatest attainable stiffness. The crank shaft is forged out of a solid steel ingot of the best quality, and is of large diameter and great strength. The connecting rod and straps are forged out of steel ingots and are of a new design, combining strength with efficiency. The main bearings are unusually large and are so arranged that both the vertical and side wear of the liners may be taken up. The main bearing liners are genuine babbitt, carefully scraped and fitted, and, as they are made removable, they can be quickly and easily taken out and replaced with new ones, if necessary. The crank pin boxes are lined with genuine babbitt. The crosshead boxes are made of pure copper and tin. The crosshead is a steel casting with very large bearing surfaces and is babbitted on the four faces with genuine babbitt. The crosshead pin is tool steel, and the piston rod a fine quality of crucible steel. The oiling devices are of the most improved form, and all fittings are complete and of the best description. The regulation by means of the improved governor is such that the engine has shown in practice, perfect regulation under conditions where the variation in load on the generator from zero to the full capacity has occurred in less than five seconds of time. Thorough workmanship and materials of the highest excellence go into the construction of the engine, and every detail receives the most careful attention. The manufacturers, the Ball Engine Company, Erie, Pa., confidently offer it with the claim that it is the best engine on the market, and for its horse power and type, the strongest and heaviest built. Believing that the electric street railway interests require a strictly first-class engine in every respect, they have designed the engine to that end, and feel that they have succeeded.

Mayor Stuart, of Philadelphia, recently vetoed the Holmesburg, Tacony and Frankford trolley ordinance. His veto was based mainly on the imperfections of the ordinance, which made no definite provision for the proper construction and maintenance of the road. A trolley railroad in the country is entirely unobjectionable and its great cheapness enables lines of comparatively rapid transit to be established where none existed before.

New Water Tube Boiler.

The water boiler illustrated in the accompanying engraving will be examined with interest for the numerous advantages claimed for it by the makers, the New York Safety Steam Power Company, 30 Cortlandt street, New York city.

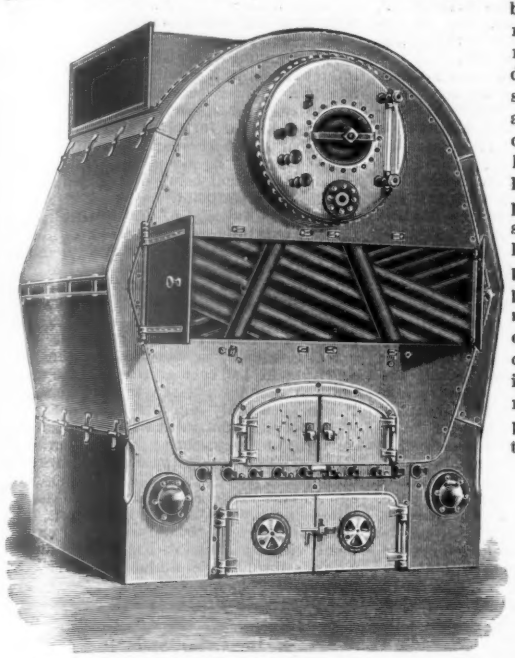


FIG. 1.—NEW WATER TUBE BOILER OF NEW YORK SAFETY STEAM POWER COMPANY.

This boiler is made under the Worthington patent.

The boiler belongs to the sectional class, designed to secure the important requisites of safety, durability, accessibility and high evaporative efficiency. The interior of the entire construction, in every part and detail, is readily accessible from the outside, for examination, cleaning or repair. The furnace extends under the entire boiler, and is of proper height to permit the use of any kind of fuel. As will be noted, upon reference to photographs, the tubes are arranged in transversely-inclined series of several tubes per section.

Fig. 1 shows a prospective view and Fig. 2 a full view of the water tube system.

Every tube is lap-welded and straight, with expanded end connection. Every tube is wholly in the furnace and directly over the fire. The movement of the water contained in the boiler is constant and rapid. Its course is as follows: From the steam and water drum located above the tubes, into which water is fed, it descends the water legs, four in number, placed outside the furnace, to the water and mud drums, at the base; thence it passes via the tube connections, into the lower system of headers; thence through the tubes, over the fire, into the upper series of headers; thence via the tube connections into the steam and water drum again, whence it started. Outside the furnace—opposite each end of each tube—a hand hole of proper size to admit a tube, or a tube expander, is provided and fitted with a cap, held to place with a cross bar and bolt. This cap is accurately faced and ground to a perfect steam and water-tight joint. The caps are exposed upon opening the side doors, and can be examined or tightened if necessary. Upon removal of a cap, the internal condition of a tube is open to inspection, to cleaning, or, in case of leakage in the expanded joint, to re expansion. And in case of accident to a tube, or depreciation due to long usage, a new tube can be substituted with but little trouble and delay.

These boilers are proportioned and rated for generating power on the basis of the Centennial standard, namely, the evaporation of 30 pounds of water at 70 pounds pressure, from temperature of 100 degrees, to be one horse-power. Said duty to be accomplished with a consumption of anthracite coal of good quality, at rate of 12 pounds per hour per square foot of grate, with good natural draft. It is to be understood that the actual steaming efficiency, and also the ultimate capacity, is largely in excess of the rating on above basis.

In a water tube boiler the elements which insure safety are numerous. Primarily, in the strength of the parts which are combined; secondly, in the reduced areas exposed to rupture; thirdly, in the distribution of the total strain. In this boiler the above mentioned factors of safety are all present. Each section of tubes and headers is tested under 500 pounds hydrostatic pressure at the works, and known to be sound and perfect before being incorporated in a boiler. The main steam drum is made of open-hearth homogeneous flange steel plate, having a tensile strength of not less than 60,000 pounds per square inch of sectional area. The plate

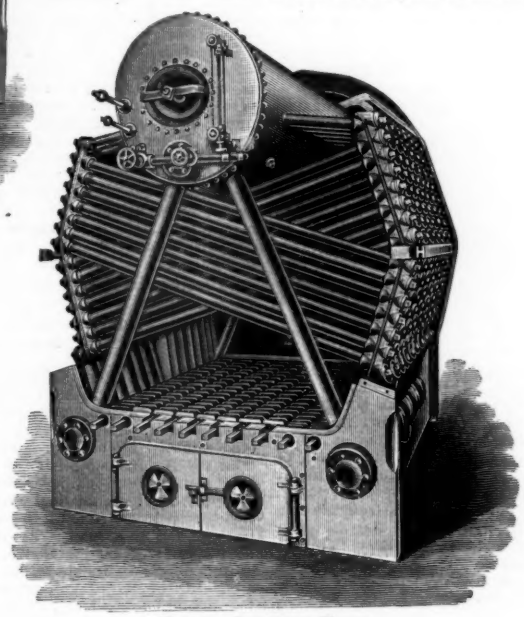


FIG. 2.—INTERIOR VIEW.

employed will be of proper thickness to enable the boiler (under government standard of pressure allowable) to carry a working pressure of 250 pounds per square inch.

When a large amount of power is wanted, and the boiler room is small, this boiler will supply the want. By reason of its sectional character, it can be delivered in places wholly inaccessible to any other desirable boiler. A boiler of 200 horse-power can be passed through a 4x4 doorway, window or sidewalk opening.

There are no screwed joints or connections in this boiler.

A Great Telephonic Achievement.

[*Evening Telegram*, New York, Nov. 21.]

The *Telegram* on Saturday, in reporting the great football match, fulfilled all its promises to its readers and exceeded their utmost expectations.

Within two minutes of the announcement of the result of that event in Springfield, Mass., 138 miles away, the *Telegram* was on the streets in New York, presenting, to the extent of several columns, an illustrated account of the match, with all of its particulars.

This was done by means of the long distance telephone, connecting the *Telegram* with an instrument on the grounds of the game in Springfield. It was literally beating the telegraph.

The achievement was unique and unparalleled.

The Bradford Self-closing Telegraph Key Company, of Clinton, Me., capital stock, $500,000, has been formed. F. J. Martin, secretary.

A Test Case in Massachusetts.

The Citizens' Gas and Electric Light Company, of Reading, South Reading and Stoneham, recently brought a petition in equity in the Supreme Court for Middlesex County, to compel the town of Wakefield to buy its electric and gas light plant, and for the appointment of commissioners to determine the price to be paid for the plant.

This case is the first one brought in this State under the act of 1891, authorizing towns to manufacture their own gas and electricity, and purchase plant for the same. The case will undoubtedly be made a test one. The value of the petitioner's plant is about $200,000, and it is offered to sell out to the town at that figure by way of compromise but the town refused to accept. This suit is the result of a long controversy betwixt the town and the company. The town at two of its meetings voted to establish and run its own gas and electric plant. By the statute of 1891, chapter 370, it was enacted that if a town voted to establish its own plant the company engaged in furnishing the town with light at the time of the vote shall have the right to sell its plant located in such place to the town.

The statute also provides that the earning capacity of the plant in addition to its actual value shall be deemed an element of value which the town shall have to pay, and it is expected that a much larger amount than the company offered to take will be recovered. The town has several times made objections to the quality of the gas furnished by the company. At the last session of the legislature it tried to have an act passed especially exempting it from buying the plant, but was unsuccessful. It applied to the State board of health to have that body decide the company's works a public nuisance, but the board declined. E. H. Capen is president and H. C. Buck treasurer of the company. The counsel for the company are E. R. Champlin and C. R. Darling.

The extensive use of incandescent lighting in New York city is exemplified by the fact that of late the various Edison stations between the Produce Exchange and Fortieth street have been carrying a load of about 28,500 amperes. This is equivalent to 57,000 sixteen candle-power lamps. It is estimated that about 150,000 incandescent lamps burn in New York every night.

ELECTRIC RAILWAY AND POWER NOTES.

The Lynn and Boston Road has a large force of men at work on the new road from Salem to Lynn, and it is expected that electric cars will run over the route some day this week.

The Brooklyn City Railroad Company are extending their lines in all directions, and lately they astonished the people of Flatbush by an invasion of workmen, who with great rapidity set up the trolley poles from the city line along Flatbush avenue.

The possibilities of a new sort of street travel, as indicated by a recent dispatch from London, are both novel and interesting. It is reported that plans have been formed in that city for running street stages by electricity, the power to be furnished by storage batteries.

The Sandusky, Milan and Huron Electric Railway has made an application to the city council of Cleveland for a franchise to construct an electric railway in that city. The road is to run between Sandusky, Huron, Milan and Norwalk, and will be completed about June 1.

Springfield, O., can now boast of a car line equipped with electric cars, thoroughly fitted out with electric heaters and incandescent lights. The trip from Belmont avenue to Limestone street used to be made in 30 minutes, while it is now accomplished in seven minutes.

At a meeting of the Street Railway Company, of Minneapolis, an ordinance was introduced to regulate the rate of speed at which the electric cars shall be allowed to run in the business center of the city. Provision was also made for the police to have certain jurisdiction over the running of the cars.

The rolling stock of the Northeast Electric Road, of Kansas City, Mo., is being entirely remodeled. This change involves the renewal of the motors and trucks of all cars used on the road. The old motors were double geared and it was necessary to drive them at 1,000 revolutions per minute to obtain ordinary speed. There was much loss of power through great friction, and the old motors were entirely unsatisfactory; hence the change. The new motors are made by the Westinghouse Company and are single geared. Each car is to carry two of them of 30 horse-power each; 25 miles per hour is the possible speed.

Treasurer Glidden, of the Erie Telegraph and Telephone Company, attributes the advance in Erie Telephone stock to the fact that the public is beginning to realize the value and condition of the company's property. He says the growth the past five years has been marvelous, and the company is increasing in subscribers to-day at a greater rate than ever before. The total increase of subscribers in the past five years has been 5,800.

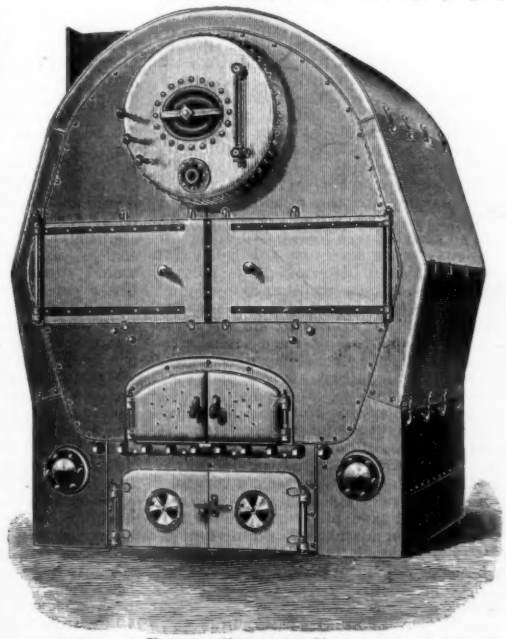


FIG. 3.—EXTERIOR VIEW.

MEDICAL ELECTRICITY.

EDITED BY DR. J. MOUNT BLEYER, NEW YORK.

Transactions of the American Electro-Therapeutical Association.

SECOND ANNUAL MEETING, HELD AT THE ACADEMY OF MEDICINE, OCTOBER 4, 5 AND 6, 1892—DISCUSSION ON DR. APOSTOLI'S PAPER.

Dr. G. Betton Massey, of Philadelphia, thought this was the most important paper which Apostoli had ever written, and he felt sure it would be instrumental in preventing many useless operations. But the invariable use of an inflexible intra-uterine electrode, in all conditions of the uterus, seemed to him simply horrible, and if one would avoid needless injury to this organ, a flexible one, covered with absorbent cotton, and moistened with water, or with a solution of cocaine, should be employed. Moderate inflammatory conditions did not contra-indicate careful electrical applications to the interior of the uterus, but where suppuration was present, and there was no free exit for the pus, such treatment was undoubtedly contra-indicated. He was convinced that all ovarian and salpingitic cases are originally uterine, and the treatment usually indicates whether or not a given case is more uterine than ovarian.

Dr. A. H. Goelet, of New York, though he had utilized bipolar vaginal faradization for its anæsthetic effect to facilitate diagnosis, had hesitated to employ the faradic current in the uterus in the manner described by Apostoli, for many cases are intolerant of intra-uterine treatment, because of the existence of an associated endometritis. The author spoke as if he thought *any one* could carry out such treatment safely, but this certainly would be unsafe teaching. Nor did he think that every case of uterine intolerance should be subjected to operative interference, for the endometritis, which is the cause of this intolerance, can be cured, and then the other treatment may be resumed. He did not share with the preceding speaker his opinion of Apostoli's electrode.

Dr. R. J. Nunn, of Savannah, thought in the high tension current, whether the faradic or static, we had an agent which would relieve the pain. There was much need for all the light possible to be thrown upon these cases, for the difficulties of diagnosis in many of them were very great. He referred to the case of a woman who had been under the treatment of an accomplished surgeon for three years before coming to him, and a diagnosis had been made of ovarian tumor, yet under the faradic current the tumor was shown to be purely hysterical, and it eventually disappeared. Regarding the dangers of intra-uterine treatment, he could only say that he had never known one of his patients to have an inflammation as a result of the introduction of an electrode. He had found the tin electrodes recommended by Dr. Goelet very useful. The question of tolerance of the current did not seem to him to be so much dependent upon inflammatory conditions as upon idiosyncrasy, and he cited in support of this view two cases at present under his care, one of which rarely tolerates 50, and the other can stand 100 milliamperes without discomfort.

Dr. A. D. Rockwell, of New York, said that before the introduction of the fine wire high tension currents, he had always considered the galvanic current the appropriate one to employ for the relief of pain, but since then he had found it extremely difficult to decide between these two forms of electricity, and in many cases he believed it was impossible to determine this point *a priori*. He had been accustomed to employ the current from what is known as "continuous coil" faradic machine of large dimensions, and had obtained from it remarkable analgesic effects, described by the author. Such a current enables one to exclude organic trouble, and sometimes also functional difficulty. Not long ago a man had been brought to him suffering from the usual symptoms of ulceration of the stomach. There was also a gastralgia, for the relief of which the current from a very long coil, run by five or six Leclanche cells, was employed. It gave him immediate relief, and the speaker afterwards ventured to express to his attending physician the opinion that there was no organic disease present. The subsequent history of this case confirmed this view.

Dr. H. H. Hahn, of Youngstown, O., said that in order to avoid the unpleasant effects likely to follow the use of stiff electrodes, and the pulling on the uterine attachments which is an accompaniment of the usual methods of manipulation, he had employed an electrode having a joint just external to the os, which allowed the uterus to assume its normal position before the current was turned on. His patients had shown great tolerance of the treatment under these circumstances, and the results had been gratifying.

Dr. Charles R. Dickson, of Toronto, said that in some cases in which stronger currents were contra-indicated, he had obtained good results by employing very weak galvanic currents, five milliamperes, for five minutes at a time, and had been able to increase the strength very gradually. He had not, however, made use of the high amperage advocated by many observers.

Dr. Walker, of Toronto, had been favorably impressed with all of Apostoli's electrodes, while watching their inventor use them in his clinic. He then referred to a case of a lady who had been subjected to laparotomy for supposed disease of the uterine appendages, but everything was found to be normal. The moral effect of the operation caused a cessation of pain for awhile, but she came to him some months later with a return of her former pain. This pain would be *instantaneously* relieved by the faradic current, and a short treatment by Apostoli's method gave her complete relief, which has continued now for 18 months.

Dr. Margaret Cleaves, of New York, said that her experience corroborated what Apostoli had said about the diagnostic value of the faradic and galvanic currents. Apostoli had been one of the first to insist that certain conditions could not be safely treated by the different forms of electricity. Her own practice is to use the faradic applications and mild currents, and always to look upon uterine pain as an indication for the use of more than the usual care in the treatment adopted, whatever may be the method selected.

Dr. W. F. Hutchinson, of Providence, said that for 10 or 12 years past he had been using high tension currents for ovarian pain, but had never met with much success until he had had constructed a machine capable of giving 25,000 or 30,000 vibrations per minute. With this number of vibrations, the anæsthetic effect was very marked, but it disappeared again when the vibrations were increased to 60,000 per minute. The fact that pain is annihilated by a certain faradic current of high tension and rapid vibration, and not by a smoothly flowing galvanic current, led one, he thought, irresistibly to the conclusion that the pain which is relieved in this way is not due to inflammation, but rather to a misplacement of polarity of the cells of the body. He believed that each form of current has a distinct diagnostic value.

The President said that the significance of intolerance to the current from a diagnostic point of view was a most important point; he was able to corroborate this from his own experience. He was sure of the analgesic effect of currents from induction coils of fine wire, and of static currents having high oscillations, whether administered by sparks or by induction from the Leyden jar coatings.

"A Contribution to the Electrical Treatment of Cystic Goitre and Hydrocele.—Also a note on Psoriasis," by Dr. Charles R. Dickson, of Toronto.

The author reported two cases, one of goitre and one of hydrocele, which he had treated by electricity. The first one was a multilocular cystic goitre, occurring in a young man. The positive electrode was placed between the shoulders and two insulated needles made of piano wire were connected with the negative pole, one being inserted in the isthmus and the other in the left lobe. A current of 30 milliamperes was used for a few minutes, and then a small electrode was placed over the tumor instead of at the back, and the current of 20 milliamperes employed for five minutes more. After the operation a simple dressing was applied. This treatment produced little change, so, thinking that greater benefit would ensue if the fluid in the cyst were a better conductor, the contents of the cyst were withdrawn with an aspirator, and the cyst then distended with an aqueous solution of chloride of sodium—one drachm to one ounce. After the electrical treatment this solution was withdrawn along with much gas. The cyst refilled, but much more slowly than it had done after the tappings. The treatment was repeated and then a compress applied so as to make firm pressure. After this improvement was steady, and four or five months later the lump had disappeared and the patient was much better in health. At that time the author firmly believed that he had permanently cured this case, but on writing to the man quite recently he learned that last June there had been some return of the swelling of the neck, and that at present the patient was trying some quack remedy. The lesson that he drew from this case was that the cyst wall should have been thoroughly obliterated, and the treatment persisted in for a longer time. In the case of the hydrocele, the patient had been tapped three times, the cyst refilling each time within three or four weeks, and he had also had on two occasions carbolic acid and glycerine injected. Seven ounces of straw-colored fluid were then withdrawn, and the sac filled with a warm salt solution, 20 grains to the ounce, and the needles used much the same as in the other case. A current of 50 milliamperes was employed for 15 minutes, and then a current of 25 milliamperes for five minutes more. The sac was then emptied, and it was noted that the quantity of fluid had been considerably decreased, and that there was much gas present. A borated dressing was applied. On the following day the testicle was strapped, in order to close the walls of the sac.

This same patient also had some spots of psoriasis on the forehead, scalp and shin, which had not yielded to treatment, notwithstanding the patient had consulted a number of eminent men. There was no specific history. To lessen the resistance to the passage of the current through these dry scales, they were moistened with salt and water, and each spot treated for five minutes with a current of from 10 to 30 milliamperes, and after repeating this treatment daily for five days, the spots were decidedly improved. He was then directed to make use of a very mild chrysophanic acid ointment—20 grains to two ounces of lard. Three months later there was no sign of the hydrocele, his general health was much improved, and he stated that the psoriasis had entirely disappeared three weeks after stopping the electrical treatment. When the injections of carbolic acid had been made for the relief of the hydrocele, he had been compelled to quit work for several weeks, whereas, after the electrical treatment, he was able to resume work in a considerably shorter time.

Regarding the strength of the current, the author said his endeavor was to use the mildest current which would prove curative, as many delicate structures were often included between the poles. When introducing the needles into the goitre, the patient should be directed to swallow, so then if the needle pierces the posterior wall, the external end of the needle will be raised during the act of deglutition. The strength of the current should be very gradually increased, and the interval between the operations should be at least one week.

SECOND DAY—MORNING SESSION.

"The Need of Greater Simplicity and Uniformity in Electro-Therapeutic Apparatus," by Dr. W. J. Herdman, of Ann Arbor.

The object of this paper was to enlarge the scope of the subject placed under the consideration of a committee at the last annual meeting. The appliances now considered essential are not a few, and hence the need for as much simplicity as is consistent with accuracy and facility of manipulation. Nine-tenths of all medical graduates have little or no knowledge of the laws governing the action of electricity, either within or without the body. If this Association would do all in its power to fix a proper standard for those desiring to practice in this branch of medicine, the colleges would soon find it to their advantage to make a knowledge of this subject a part of their curriculum, or possibly one of the entrance requirements. There is much need for more uniformity in the construction of instruments, and particularly as regards the shape, size and material of electrodes. There is also no good reason why instruments should not be made so that repairs can be made by the physician himself, and so avoid the present expensive and vexatious delays. He was in favor of appointing at this meeting committees to report on standards for static machines, constant current generators and electrodes. He did not claim that even with standard instruments uniform results would be obtained by different observers, for the personal equation must be taken into consideration; he did claim, however, that we should endeavor as soon as possible to determine the value of this personal equation.

DISCUSSION.

Dr. Hutchinson said that the author's remarks on the importance of greater simplicity of construction and facility in repairing harmonized exactly with what he had been urging for many years past; he had fought with all his might against hidden and inaccessible parts of machines, and particularly against closed cells.

Dr. Goelet was glad to see that the others recognized the same difficulties which he had had to contend with in the use of imperfectly constructed apparatus. The lack of uniformity in the construction of our appliances was felt most keenly perhaps in consultation practice, where it was often sufficiently potent to put to nought the advice given by the consultant. The tendency to economize in the construction of electro-therapeutic apparatus is a great mistake, and although he had himself been guilty of recommending the use of cheaper materials in the construction of electrodes, for instance, the dehydrogenized iron as a substitute for platinum, he had seen his mistake and could say most positively that nothing so far devised can equal platinum for this purpose, unless the claims for a new alloy of lead, described in the *Pacific Record* of September 15, 1892, proved after practical tests to be well founded.

Dr. Waite, by invitation, said that one of the chief obstacles presented to the manufacturer was the lack of knowledge on the part of the purchaser as to just what is wanted. The voltage of the instruments in market is well known; the trouble is with the electrodes. The variations in the different faradic coils were due to many factors, and he saw no way of securing uniform construction, except by extended experiments with many different machines.

Dr. Nunn said if the manufacturers could only be induced to make the connections interchangeable, it would be a great step in advance. There seemed to be no good reason why this association should not adopt a standard for plugs and screws. In determining the standard for coils, much latitude should be given, the requirements for a standard coil being determined from a therapeutic standpoint.

Dr. J. H. Kellogg, of Battle Creek, said that the only way to obtain an exact knowledge of what is wanted in a medical induction coil is to make a careful and elaborate study of tracings taken from the currents of many different kinds of coils. He was at present engaged in such a study, and it promised to be very fruitful of results.

Dr. Herdman, in closing the discussion, said that he had been gratified at the unanimity of opinion evinced in the discussion. It had been truly said that we do not know what we want, but we shall never make any progress unless we start. We are ourselves responsible for what the manufacturers are doing, and as a national organization, we should take this matter in hand, and if committees are appointed to do this work, they should not forget the physiological experiments alluded to by Dr. Kellogg, for such a study is absolutely essential to accuracy and completeness of the work.

(To be continued.)

What is the Color of an Incandescent Filament?

The color of incandescent particles has been proven to be a most fruitful subject for discussion. Mr. T. C. Porter describes how he tried a similar experiment with the incandescent filament of an electric lamp.

Using an 80-volt, 16 candle-power lamp, he passed a current from a storage battery through the lamp and a water resistance, which was gradually reduced by the addition of sulphuric acid. The room in which the experiment was performed was carefully darkened, and the observers were kept in darkness some minutes before the current was switched on. As the current was increased by regular stages, the observers (25 in number) carefully inspected the lamp in rotation, and everyone wrote down his impression of the color of the filament in the dark, so that the eyes were not affected by the extraneous light. It was unanimously decided that the color of the filament was at first very pale. Thirteen called it a very pale yellow, three took it for white, seven for a faint pink, two for a bluish white. All agreed that as the temperature rose the color grew deeper and redder, passing through orange before arriving at crimson. The words used to designate the final tint reached in the experiment varied from deep reddish orange to copper color, dark red, blood red and crimson. In diffused daylight this would be a dull red.

This experiment seems to go to show that we are partially color blind when faint colors are viewed; and that the fine appreciation of and distinction between colors of low intensity is variable in different persons.

Shunted.

[From the Chicago *Daily Tribune.*]

"So you are in the electrical engineering line," said the traveler in the palace car to the chance fellow traveler with whom he was exchanging fragments of personal history. "There has always been a fascination for me in that field of research. By the way, don't you think—"

"Beg pardon," hastily interrupted the other, taking from his pocket and handing to him a well worn card, inscribed:

No, the Science of Electrical Engineering
IS NOT
In Its Infancy!

And the conversation gradually drifted to other subjects.

The citizens of Marcus Hook, Pa., interfered with the employés of the Pennsylvania Railroad Company and prevented them from blocking the trolley line, which the Union Railroad Company, of Chester, is introducing into the borough. The railroad men tore up the trolley tracks and began laying their own, when the citizens of Marcus Hook, who are anxious for the introduction of the trolley, arrived on the scene in force and tore up the Pennsylvania tracks. The laborers resisted until they were outnumbered by the citizens.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

UHRICHSVILLE, O.—The electric street cars between Uhrichsville and Dennison are doing a good business, and as a consequence there is talk of another electric line to be built between this town and New Philadelphia.

HORNELLSVILLE, N. Y.—The Hornellsville Electric Railway Company will extend its lines.

ELMIRA, N. Y.—It is reported that the Elmira and Horsehead Railway Company contemplates substituting electricity for steam on the Horsehead division.

BATAVIA, N. Y.—The board of aldermen has under consideration a petition from a Rochester engineering firm for a 50-year franchise to build an electric street railway.

ALFRED, N. Y.—Alfred wants electric railway connection with Hornellsville.

PALMER, MASS.—A company has been formed to construct an electric street railway, to start at South Monson and take in Monson, Palmer and Wilbraham. The capital stock of the company is $60,000, and A. M. Young, of Waterbury, is the largest stockholder.

HARRISBURG, PA.—The Jeannette and Penn. Electric Street Railway Company, Westmoreland County; capital, $30,000.

OXFORD, PA.—It is proposed to build a new electric railway from Oxford to Newark.

LINWOOD, N. J.—A meeting was held here, recently, to formulate plans for the organization of a company to construct an electric railway from Somer's Point to Atlantic City. Thirty-thousand dollars have been subscribed and the road is an assured fact.

NEWTON, MASS.—George D. Morse, Horace B. Parker and others, of Newtonville and Newton, have organized a company to build a street railway from Newtonville to Watertown.

CANANDAIGUA, N. Y.—In accordance with a provision in the franchise of the Canandaigua Street Railway, that company will suspend operations until January. In the interim a complete change will be made in the tracks and equipment, and the electric trolley system will be adopted.

BRISTOL, PA.—There is talk of an electric railway to be built from Bristol to Doylestown.

SAN JOSÉ, CAL.—Burke and Henry are applicants for a franchise to operate an electric railway here.

LANCASTER, O.—The Lancaster Street Railway, E. B. Dyer, president, has been sold to New York parties, who will change the system to electricity and extend the line six miles.

ASHLAND, PA.—Ashland, Locust Dale and Centralia Electric Railway Company; length, 10 miles; capital, $60,000. Promoters, Josiah F. Bailey, Philadelphia, Pa.; C. E. Winters, Springfield, O.

REYNOLDSVILLE, PA.—The Reynoldsville and Rathmel Electric Street Railway Company; length, 4 miles; capital, $25,000. Promoters, F. K. Arnold, W. C. Coleman, Reynoldsville, Pa.

ASHLAND, PA.—Schuylkill Traction Company; capital, $10,000. Directors, J. F. Bailey, president; J. H. Cofrode, F. E. Bailey, Philadelphia; C. E. Winters, A. A. Winters, Springfield, O.

SCRANTON, PA.—The Scranton Traction Company; capital, $100,000. Edwin E. Denniston, of Germantown, Pa., is president of the road and owns 1,980 of the 2,000 shares of stock.

HAZLETON, PA.—The Lehigh Traction Company; capital, $10,000. Directors, D. L. Patrick, H. A. Fulton, D. A. Fell, Jr., G. R. Bedford, L. B. Landnesser.

HARRISBURG, PA.—The Dillsburg, York Springs and Gettysburg Street Railway Company will connect the towns in title of company; length, 22 miles; capital, $150,000. Promoters, Wm. H. Egle, Jno. C. Comfort, Harrisburg, Pa.; Jno. A. Gardner, Uriah, Pa.

EASTON, PA.—The Easton and Bethlehem Transit Company; length, 10 miles; to connect Easton and Bethlehem; capital, $125,000. Howard Mutchler, president; E. H. Sawback, secretary, Easton, Pa.

LOCK HAVEN, PA.—The Lock Haven Street Railway Company; length, five miles; capital, $30,000. Henry T. Harvey, president; Thos. R. Man, secretary, Lock Haven.

NANTICOKE, PA.—Nanticoke and Newport Railway Company; connects the towns mentioned in title; length, eight miles; capital, $50,000. Thos. T. Shea, president; Jno. B. Reynolds, Nanticoke.

PHILADELPHIA, PA.—The Philadelphia, Cheltenham and Jenkintown Passenger Railway Company; length, 10 miles; capital, $60,000. Promoters, Jno. H. Fon, Esq., president, Philadelphia, Pa.; Jacob R. Kline, Bustleton, Pa.

JEANNETTE, PA.—The Jeannette and Pennsylvania Electric Railway Company; length, two miles; capital, $30,000. Promoters, Geo. Wagoner, H. J. Chase, Jeannette, Pa.

HAZLETON, PA.—Hazleton and North Side Electric Railway; capital, $75,000; length, 12¼ miles. Promoters, Alon Markle, Hazleton, Pa.; P. J. Ferguson, Shenandoah, Pa.

SHAMOKIN, PA.—Shamokin and Mt. Carmel Electric Railway Company; length, 10 miles; capital, $100,000. Promoters, E. C. Hamilton, Shamokin, Pa.; D. J. Lewis, Mt. Carmel, Pa.

HAZLETON, PA.—Beaver Meadow, Hazleton, Mahanoy and Shenandoah Electric Railway Company; length, 25 miles; capital, $150,000. Promoters, H. Markle, Jno. J. McKeehan, Hazleton, Pa.

KANSAS CITY, MO.—The New York and London Electric Construction Company has been incorporated with a capital of $50,000. Incorporators, W. C. Wilson, W. H. Ehlers and J. R. Faran.

CORNING, N. Y.—Mr. John A. Seeley and a number of New Yorkers have incorporated the Citizens' Electric Railway Company, with a capital of $100,000.

JACKSONVILLE, FLA.—It is reported that the Main Street Railway Company will equip its road electrically.

SIOUX CITY, IA.—The Sioux City Rapid Transit Company is figuring on a change in the method of operating the elevated road, and is negotiating with electrical equipment companies for the equipment of the line with the trolley system.

STOCKTON, CAL.—The owners of the electric railway have formed two corporations to engage in furnishing electric power and to run an electric railway from Stockton to Lodi.

Electric Light and Power.

PHILADELPHIA, PA.—The Columbia Electric Light Company has been incorporated with a capital of $100,000, for the purpose of furnishing light and power in Philadelphia.

ANDERSON, IND.—The city of Anderson is preparing to build a $35,000 electric light plant. Subscriptions have been submitted to the council and work will begin at once.

OTTAWA, CAN.—The Automatic Telephone and Electric Company, of Canada, has been organized.

COLUMBIA, MO.—W. T. Anderson, of St. Louis, has been granted a 20 years' franchise by the city council for waterworks and an electric light plant. The city will pay $5,000 annually for its light and water.

JEFFERSON, O.—The Jefferson Light and Power Company; capital, $10,000.

BRANTFORD, CAN.—The Brantford Electric Lighting Company; capital, $150,000. Promoters, William Buck, George C. Schultz, A. Watts, J. W. Digby and others.

PALMER, MASS.—E. P. Ball has nearly completed plans for the new electric light station to be built at Blanchardville for the Palmer and Monson Electric Company.

REDLANDS, CAL.—The Redlands Electric Light and Power Company is the name of a new corporation that desires to furnish light for this city. It has a capital stock of $200,000, and the value of its plant will be upwards of $90,000. It has secured the Mill Creek water, and turns it into its pipe so far above the irrigated section that an immense pressure is given, affording a minimum of 700 horse-power.

RICO, COLO.—The Colorado Light and Power Company is now organized, incorporated and is rapidly getting ready for business. The capital stock is $50,000 and is mostly held among Rico's business men. The company have secured ground near the railroad depot and have commenced the erection of a large fireproof building, 40x44 feet.

BRADDOCK, PA.—The People's Electric Light Company, recently chartered with a capital stock of $35,000, has commenced the construction of an electric light plant between Braddock and Copeland, to be equipped with 600 horse-power.

New Manufacturing Companies.

KITTERY, ME.—The Sevigné Specialty Company; capital, $499,970; $30 paid in. President, Henry A. Sevigné, of Boston, Mass.; treasurer, Russell A. Ballou, of Newton, Mass. The company will manufacture and sell insulating, electric wiring, dress forms, etc.

CHICAGO, ILL.—The American Electrical Construction Company; capital, $25,000. Incorporators, G. A. Harter, S. P. Camp and Walter J. Gunthrop.

CANTON, O.—The Canton Electrical Company; capital, $10,000; has been incorporated.

WARREN, O.—Articles of incorporation of the Warren Electric and Specialty Company have been filed with the Secretary of State at Columbus; capital, $15,000.

PORTLAND, ME.—The Heinze Electric Company; capital, $10,000. President, F. A. Norwood; treasurer, W. M. Currier, of Lynn, Mass.

Increase of Capital Stock.

CINCINNATI, O.—The Electric Supply and Contracting Company has increased its capital from $5,000 to $10,000.

SOUTH OMAHA, NEB.—The South Omaha Electric Light Company will increase its capital and enlarge its plant.

The copper situation is becoming very interesting, says the Boston *News-Bureau*. That there is a legitimate demand for the metal at ruling prices is most certain, as is also the fact that producing companies have not anything like their usual stock on hand. Mr. J. B. Haggin will undoubtedly close down the Anaconda, and it is good opinion that the consideration for such action lies in his personal interest in copper and copper shares. Mr. Haggin says the mine was not to be closed until all the ore and flue dust had been cleaned up.

Electricity In the Art of War.

Under this title Lieut. C. D. Parkhurst, Fourth Artillery, U. S. A., published an exhaustive essay in a recent issue of the *Journal of the United States Artillery*. The following is an abstract of the the article:

To fully enumerate the various arts and sciences now available for the art of war would be to recapitulate each and every art and science that makes our civilization possible. Among these, however, we may select those that have the greatest prominence; as such we have steam and electricity.

With steam the locomotive became a possibility and an accomplished fact. With electricity our vast net-work of railroads became practicable. These two sciences are inseparable in our modern railway, and our present civilization would be impossible without either. Annihilate the telegraph and our modern railroad would sink at once to a lame and feeble service until some equally good and reliable system of signaling could be devised; our vast system for interchange of news and ideas would vanish, and we would be forced back a century in our means and methods for ordinary business or war.

The telegraph is now recognized as an indispensable part of the equipment of every army in the field, and the instances of its use are absolutely innumerable. During the last part of the civil war over 3,000 miles of line were constructed, 2,000 miles taken down or abandoned, and 6,000 miles were in operation at the close of the war. It is estimated that from the commencement of the rebellion to June 30, 1865, there had been constructed and operated about 15,000 miles of United States military telegraph—land, submarine and field lines.

An incident of this war (Turco-Russian) gives a marked instance of the use of the telegraph upon the field of battle. At the battle of Aladja Dagh near Kars, the Russian plan was to assault the Turkish fortified position in front with a force of about 30,000 men, while a turning column of 15,000 men was to make a complete *détour* of more than 40 miles, passing beyond the Turkish right through a mountainous country and strike the center of the rear. The telegraph gave the means of making the attack simultaneous, and in this case the turning column threw out a thread of wire behind it, by means of which it remained in full and constant communication with the main body. The attacks were made simultaneously, and they absolutely destroyed the Turkish army. Its defeat made possible the storming of Kars, and sealed the fate of the campaign in Asia Minor. Regarding the telegraph line itself, it is said to have been built rapidly, to have worked during the attack on Mount Oghur and during the subsequent battle. It was guarded by cossacks, and was not in working order during only two hours, and upon it depended the success of the campaign in Arminia.

There is one point that is worthy of mention, that can just barely be touched upon in the use of steam and electricity in war, under the conditions that must necessarily obtain in this country. That point is that our vast net-work of roads and telegraph lines that become of such vital importance in the event of war, are private commercial enterprises operated by civilians, and generally free from all government control.

In the event of war, upon anything like the grand proportions of our civil war, or the proportion due to the size and population of our country, this net-work of roads and telegraph lines becomes at once an absolute necessity for military use in the handling of troops, in mobilization and in concentration of food, stores and munitions.

These civilian commercial corporations then become as important and indispensable as any of our heads of military departments. Upon the integrity and loyalty, not only of the corporation, but of every train and lineman the success of a movement may depend. Some of our railways extend into Canada and Mexico. Any war involving either of these countries would see a corporation exposed to the loss of road-bed and rolling stock that might be in the hostile country. Hence, want of sympathy or downright disloyalty on the part of such a corporation or its employés might cause delay, if not disaster. Cipher dispatches would not alone prevent this, for delay in sending, transmitting or delivering such a message, its contents being only suspected, might work the mischief as much as though the actual contents were known. An engineer, train despatcher, flagman, switchman or any other supposed to be trusted trainman, could ditch, disable or stall a train moving troops or stores, and thus work delay or disaster.

Do not then the trainmen and telegraph operators of all our lines become of as much, if not more, importance than any combatant under arms? And should they not be so recognized and be regularly enrolled in the event of war as part of the army's working force?

(To be continued.)

KINDRED INTERESTS

The Short Electric Railway has opened new offices at 44 Broad street, N.Y., and invite all customers to pay them a visit.

The Nicholson File Company, of Providence, R. I., has facilities for producing between 30,000 and 40,000 files daily, and make over 3,000 varieties.

The William A. Harris Steam Engine Company, of Providence, has under consideration a departure in engine building which will interest power users.

The Belknap Motor Company, of Portland, Me., has bonded a water power, and will erect an electric light and power plant by which Freeport and Yarmouth, Me., will be lighted.

Mr. J. P. Kelly, of Biddeford, Me., manufacturer of cleaver springs, stirrups, etc., has recently started a brass foundry and machine shop for the manufacture of finished or unfinished castings, phosphor-bronze and aluminum bronze.

J. Jones & Son have placed on the market a contact protected bell. Excellent materials are used throughout and the best workmanship is employed in its manufacture. The contact screw is held in position by a flexible insulator and is unaffected by heat or cold. The contact points are enclosed in a sealed air-tight chamber and are thereby kept free from dust.

The Central Electric Company have just taken the agency for a combination tin shade, both flat and cone shaped. These shades are under patent by F. H. Soden, and will be known as the "Central Combination Shades." The trade can have their wants supplied by applying to the Central Electric Company, who will carry them in stock hereafter.

The Clark Electric Company is meeting with great success in introducing its arc light intended for interiors. It is elegant in conception and tasty in designs. It can be used on arc or incandescent currents, in series or single. Many of them are in use in New York, and give perfect satisfaction. The company makes a specialty of manufacturing electric arc lighting apparatus for every purpose, and has general offices at 192 Broadway.

The Berlin Iron Bridge Company, of East Berlin, Conn., have taken the contract for a new machine shop to be built at Newport News, Va., for E. C. Hillyer & Company. The building will be 82 feet in width, divided into a center portion 40 feet between crane girder columns, with a wing on each side 21 feet in width. The wings will be two stories high, the balcony floor being used for light work. The central portion of the building will be controlled by a 20 ton traveling crane.

Mr. Pierre Duvinage has severed his connection with the Crocker-Wheeler Electric Company, where he had charge of the testing department, and has started in business under the firm name of P. Duvinage & Company, electrical and building contractors, electric light and power plants, and the Duvinage system of anchor plates and post caps for self-releasing beams for anchoring buildings. The general offices are in the Arbuckle building, and the foundry is 79 to 85 Bedford avenue, Brooklyn.

The Railway Equipment Company, of Chicago, has published an illustrated catalogue of its specialties for the furnishing of overhead equipment for electric roads. The special hard rubber composition now furnished by the company shows a higher degree of insulation than many other insulating materials. The overhead devices manufactured by them are simple, practical and reliable. McTighe insulators, etc., are among their specialties, and the company also manufactures the Ahearn electric heating appliances. The company is prepared to furnish anything needed in this line and solicit opportunities of estimating on special work.

TELEGRAPH NEWS.

A new telegraph line has been run between Fort Niagara and Youngstown, N. Y.

In Buffalo, on the night of November 18, there were 1,000 messages filed which could not be transmitted to New York.

Telegraph operators on the N. Y. P. & O. road have been granted an average increase in wages of $5 per month as the result of negotiations which have been carried on for some time past.

The Erie lines have advanced the wages of every telegraph operator, train dispatcher, and every agent acting as operator in their employ. A minimum scale of wages of $45 a month is established, and from this amount the usual advances are made.

The telegraph operators, employed by the Baltimore & Ohio Company, have won a partial victory in their struggle for higher salaries. An agreement is reported which gives the operators an increase of $35,000 a year, a little more than a quarter of the amount asked.

The recent storms in New York State have done great damage to the telegraph lines and several cities have been without telegraphic communication for a number of hours. One operator writes that all dispatches are being sent by mail as soon as they are received.

The city of Chattanooga has been troubled with a man who seems to take great pleasure in cutting the wires of the lines belonging to the Postal Telegraph Company. The police have been looking for the man, whom they have named "Jack, the wire cutter," but as yet they have been unable to find him.

The threatened strike of the Queen & Crescent has been happily averted. The men received word from Cincinnati that President Felson had signed the schedule. Concessions were made by the men, but as a whole the agreement is very favorable to the operators. The amicable settlement of what had assumed the shape of a very formidable and disastrous tie-up of one of the largest railway systems of the South, will be hailed with delight by everybody who has any interests whatever in Southern territory.

A Change in Telegraph Counts.

There seems to have been some cause which has necessitated a change in the counting of words in telegrams, for Gen. Thomas T. Eckert, acting president of the Western Union Telegraph Company, has issued an order regulating the counting of words and numerals in telegrams. Under the new rules dictionary words, initial letters, surnames of persons, names of cities, or the abbreviations thereof, will be counted and charged for each as one word. When names of countries or counties occur, all of the words will be counted, for example, "Queen Anne County," will be taken as three words.

Figures, letters, commas, points and bars of division, or any combination thereof, will be counted, each group being taken separately, three figures, letters or signs to the word; and any group of less than three figures, letters or signs will also be counted as one word, viz.: "52 C 731," two words; "53,000,000," three words; "per cent.," two words, except in cases of "A.M.," "P.M.," "F.O.B.," "C.O.D.," etc.

The cost of cipher messages will be increased by this system, but the tolls upon ordinary messages will be decreased.

General Eckert has also issued a circular authorizing all managers to send "Collect," without a guarantee, any telegrams offered by traveling agents or representatives addressed to their home firms, upon the presentation of proper credentials.

The Bell Telephone output for the month ending November 20, is as follows:

	1892.	1891.	Inc.	Dec.
Gross output	6,990	5,767	1,223	....
Returned	4,247	3,667	580	....
Net	2,743	2,100	643	....

From December 20, 1891 to November 20, 1892:

Gross	86,809	64,357	22,452	...
Returned	50,191	39,240	10,951	....
Net	36,618	25,117	11,501	....

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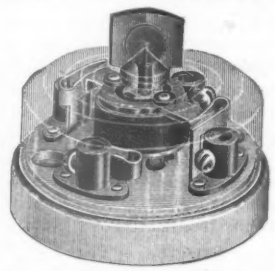

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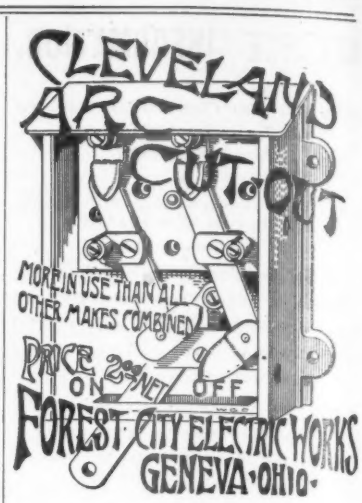

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Engine Lathes, 10 in. x 4 ft.; 11 in. x 5 ft.; 12 in. x 6 ft.; 14 in. x 6 ft.; 16 in. x 6 ft.; 18 in. x 8 ft.; 20 in. x 9 ft., with tapes attachment; 22 in. x 12 ft. and 14 ft.; 24 in. and 26 in. x 16 ft.; 30 in. x 10 ft. and 14 ft.; 36 in. and 38 in. x 20 ft.; 42 in. x 12 ft.; 27 in. x 32 ft.; 88 in. x 31 ft.; 96 in. x 30 ft. Fox Lathes, 13 in. x 5 ft.; 14 in. x 5 ft.; 15 in. x 6 ft.; 18 in. x 6 ft. Turret Lathes, 12 in. x 5 ft.; 14 in. x 5 ft.; 15 in. and 16 in. x 6 ft.; 18 in. x 6 ft.; 36 in. x 8 ft.

Planers, 16 in. x 16 in. x 3 ft.; 20 in. x 20 in. x 4 ft.; 24 in. x 24 in. x 6 ft.; 30 in. x 30 in. x 6 ft.; 36 in. x 36 in. x 10 ft.; 42 in. x 42 in. x 12 ft.; 44 in. x 48 in. x 22 ft.; 60 in. x 49 in. x 24 ft.

Friction Shapers, 15 in., 16 in., 20 in., 22 in., 32 in.

Crank Shapers, 6 in., 8 in., 10 in., 12 in., 13 in., 16 in., 17 in., 20 in., 24 in., 28 in.

Screw Machines, Nos. 1, 2, 3, 4, with or without Wire Feed.

Screw Machines, Nos. 5, 6, 7, 8, Power Feed.

Presses, Nos. 51, 52, 53, Ferracute; Nos. 1, 2, 3, Stiles & Parker.

5 Lincoln Pattern Millers, No. 2.

Hand Millers, Nos. 1 and 2. 3 Cam Cutters.

Bolt Cutters, ¼ in. to 1 in., ½ in. to 2 in.

2 Profiling Machines. 1 36 in. and 48 in. Gear Cutter.

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